Vol. 10, No. 7
April 15, 1985

Energy Research Abstracts

Abstracts 10829-12031

Office of Scientific & Technical Information
UNITED STATES DEPARTMENT OF ENERGY

CURRENT AWARENESS PUBLICATIONS ON ENERGY

To provide complete coverage of literature related to major Department programs, announcement publications that are comprehensive in their coverage of certain energy fields are issued regularly. All information in these publications, plus additional backup information, is included in the Energy Data Base of the Office of Scientific and Technical Information; all references are also available for machine searching via the on-line retrieval system, DOE/RECON, and the commercial on-line retrieval systems. Descriptions of these current awareness publications, which are supported either directly or indirectly by the DOE, appear below. Department of Energy components may receive the listed publications free from the Office of Scientific and Technical Information, U. S. Department of Energy, P. O. Box 62, Oak Ridge, TN 37831. Telephone (615) 576-1301; FTS 626-1301.

PUBLICATIONS OF THE OFFICE OF SCIENTIFIC AND TECHNICAL INFORMATION

Energy Abstracts for Policy Analysis (EAPA)

A monthly abstract journal devoted to the analysis of energy research, conservation, and policy. Scope and coverage are limited to substantive articles or reports and emphasize legislative, regulatory, and other legal aspects, as well as social, economic, and environmental impacts. *EAPA* is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The annual subscription price is $72.00 for domestic (North America) or $90.00 for foreign (outside North America) subscribers; a single issue is $5.00 or $6.25, respectively.

Energy Research Abstracts (ERA)

A comprehensive semimonthly abstract journal devoted to all areas of energy-related information produced by the Department of Energy, other U. S. government organizations, and foreign governments. *ERA* is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The annual subscription price for the 24 issues is $146.00 for domestic (North America) subscribers or $182.50 for foreign (outside North America) subscribers. A single issue is $14.00 or $17.50, respectively.

DOE Patents Available for Licensing (PAL)

DOE is prepared to grant exclusive or nonexclusive, revocable licenses under DOE-owned U. S. patents and patent applications; this semiannual publication provides abstracting and indexing coverage of this literature. *PAL* is available on subscription (use PB85-946800) from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. The annual subscription price is $14.00 for domestic (North America) or $28.00 for foreign (outside North America); a single issue is $8.00 or $16.00, respectively.

Energy Meetings (EM)

A monthly listing of conferences, symposia, workshops, etc., pertaining to DOE's programmatic interests. *EM* is available on subscription (use PB85-901500) from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. The annual subscription price is $40.00 for domestic subscribers and $80.00 for subscribers outside the North American continent; a single issue is $5.00 and $10.00, respectively.

The following monthly update journals are available to the public on subscription from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161; use the identifying order number (PB- No.) when subscribing. The annual subscription price (12 issues plus cumulative index) is $75.00 for domestic (North America) and $150.00 for foreign (outside North America) subscribers; a single issue is $7.00 and $14.00, respectively.

***Current Energy Patents (CEP)*–PB85-902800**

Devoted to international patent literature, including patent applications, on any aspect of energy production, conservation, and utilization.

***Energy and the Environment (EAE)*–PB85-914900**

Devoted to information on the impacts of energy-related activities and radioactive and nonradioactive pollutants on the environment.

***Fossil Energy Update (FEU)*–PB85-914600**

Devoted to information on the exploration, development, processing, and use of fossil fuels.

***Fusion Energy Update (CFU)*–PB85-915300**

Devoted to information on controlled thermonuclear fusion, including plasma and fuel research and power plant engineering and conceptual design studies.

***Solar Energy Update (SEU)*–PB85-914500**

Devoted to information on the utilization of solar energy, including biomass and tidal and wind power.

The following semimonthly bulletins are also available from the National Technical Information Service. The annual subscription rate for one volume (calendar) year (24 issues; no indexes) is $40.00 for domestic (North America) and $80.00 for foreign (outside North America) subscribers; use the identifying order number (PB- No.) when subscribing.

***Acid Precipitation (APC)*–PB85-901000**

Covers all aspects of acid precipitation, including effects and possible control measures.

***Buildings Energy Conservation (BEC)*–PB85-900700**

Covers worldwide information on the technology required for energy conservation in buildings of all types.

***Coal-Based Synfuels (CBS)*–PB85-901400**

Covers all aspects of conversion of coal into gaseous or liquid fuels.

***Coal Preparation and Pollution Control (CPC)*–PB85-900800**

Covers all aspects of coal preparation and cleaning and reducing pollution from its direct combustion.

***Direct Energy Conversion (DEC)*–PB85-946600**

Covers the following areas: photovoltaics, magnetohydrodynamics, electrohydrodynamics, thermoelectrics, thermionics, and fuel cells.

***Energy from Biomass (EFB)*–PB85-900600**

Covers worldwide information on all aspects of biomass production, conversion, and utilization for energy.

***Geothermal Energy Technology (GET)*–PB85-914700**

Covers information on the exploration, development, and utilization of geothermal resources.

***Heavy-Ion Reactions (HIR)*– PB85-900500**

Covers all aspects of heavy-ion (A > 4) reactions.

***Laser Research (LAR)*–PB85-901100**

Covers all aspects of laser research and development, but excludes applications.

***Nuclear Fuel Cycle (NFC)*–PB85-913400**

Covers all aspects of the nuclear fuel cycle, both front end and back end.

***Nuclear Reactor Safety (NRS)*–PB85-913500**

Covers the safety aspects of accident analysis, safety systems, radiation protection, decommissioning and dismantling, and security measures.

***Radioactive Waste Management (RWM)*–PB85-902900**

Covers the management aspects of transport and storage, waste processing, waste disposal, waste storage, radioactive effluents, and shipping containers.

***Solar Thermal Energy Technology (STT)*–PB85-901200**

Covers research in materials, concentrators/receivers, salinity gradients, etc., for development of efficient and reliable solar thermal conversion systems.

***Unconventional Petroleum (UCP)*–PB85-901300**

Covers all aspects of secondary and tertiary recovery of petroleum and of oil shales and tar sands.

INTERNATIONAL ENERGY PUBLICATIONS

The Office of Scientific and Technical Information (OSTI) cooperates in the publication of international abstract journals with the following: (1) International Atomic Energy Agency, International Nuclear Information System, Vienna, Austria, for *Atomindex;* (2) International Energy Agency, Biomass Conversion Technical Information Service, Dublin, Ireland, for *Biomass Abstracts;* and (3) International Energy Agency, IEA Coal Research, London, England, for *Coal Abstracts.* In each case, the cognizant foreign agency provides the non-U. S. information to OSTI for inclusion in the Energy Data Base; in turn, OSTI provides the U. S. information for input into the respective journal.

Atomindex

A semimonthly abstract journal providing worldwide coverage of information on nuclear science and technology. *Atomindex* is available by subscription from UNIPUB, 345 Park Avenue South, New York, NY 10010. The cost of an annual subscription, 24 semimonthly issues and semiannual and annual cumulative indexes, is $290.

Biomass Abstracts

A bimonthly abstract journal with comprehensive coverage of information in any step involved in the eventual conversion of biomass to energy. *Biomass Abstracts* is available free to Department of Energy components and contractors from OSTI. Non-DOE organizations may obtain *Biomass Abstracts* from Biomass Conversion Technical Information Service, Institute for Industrial Research and Standards, Ballymun Road, Dublin 9, Ireland, for 42 IR pounds per year. Make checks payable to the Institute.

Coal Abstracts

A monthly abstract journal providing comprehensive worldwide coverage of information in the field of coal science and technology. *Coal Abstracts* is available to Department of Energy components and contractors from OSTI. Non-DOE organizations may obtain *Coal Abstracts* from IEA Coal Research, Technical Information Service, 14-15 Lower Grosvenor Place, London SW1W 0EX, England, for 100 pounds sterling per year.

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ENERGY RESEARCH ABSTRACTS

ABOUT THE OFFICE OF SCIENTIFIC AND TECHNICAL INFORMATION

The Office of Scientific and Technical Information (OSTI) in Oak Ridge, Tennessee, has been the national center for scientific and technical information for the Department of Energy (DOE) and its predecessor agencies since 1946. In developing and managing DOE's technical information program, OSTI places under bibliographic control not only DOE-originated information but also worldwide literature on scientific and technical advances in the energy field and announces the source and availability of this information. Whereas the literature of science is emphasized, coverage is extended to DOE programmatic, socioeconomic, environmental, legislative/regulatory, energy analysis, and policy-related areas. To accomplish this mission, OSTI builds and maintains computerized energy-information data bases and disseminates this information via computerized retrieval systems and announcement publications such as abstracting journals, bibliographies, and update journals. Direct access to OSTI's most comprehensive data base, the Energy Data Base, is available to the public through commercial on-line bibliographic retrieval systems. The Energy Data Base and many of OSTI's energy-related data bases are available to DOE offices and contractors and to other government agencies via DOE/RECON, the Department's on-line information retrieval system. The Office of Scientific and Technical Information has developed and maintains systems to record and communicate energy-related research-in-progress information, to maintain a register of DOE public communications publications, to track research report deliverables from DOE contractors, and to test and make available DOE-funded computer software programs with scientific and management applications; OSTI also serves as adviser for special publication needs of the Department. To effectively manage DOE's technical information resources, OSTI's program is one of continual development and evaluation of new information products, systems, and technologies.

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ABOUT *ENERGY RESEARCH ABSTRACTS*

Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U. S. Department of Energy, its laboratories, energy centers and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. The user should remain aware that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.

ERA is comprehensive in its subject scope, encompassing the DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

ERA is available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. Inquiries should be directed to the Office of Scientific and Technical Information, P. O. Box 62, Oak Ridge, TN 37831.

ERA is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $146.00 for domestic subscribers and $182.50 for foreign subscribers. A single issue costs $14.00 (domestic) or $17.50 (foreign). The cumulative indexes will be available in printed form from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, and in microfiche form from the National Technical Information Service, U. S. Department of Commerce, Springfield, VA 22161, and from Engineered Systems, P. O. Box 866, Oak Ridge, TN 37831.

Office of Scientific and Technical Information
United States Department of Energy, P. O. Box 62, Oak Ridge, TN 37831

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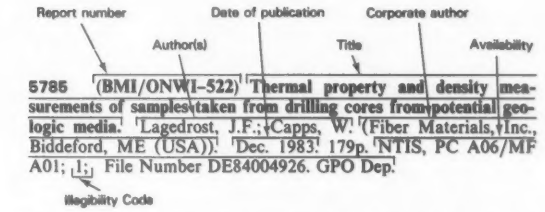
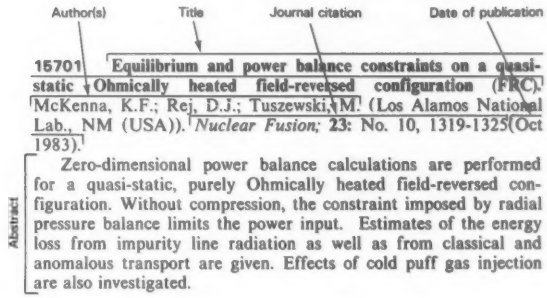
ABSTRACTS IN *ENERGY RESEARCH ABSTRACTS*

The principal elements of abstract entries for a typical research and development report and a typical technical journal article are illustrated below.


Report number
Date of publication
Corporate author
Author(s)
Title
Availability
5785 (BMI/ONWI-522) Thermal property and density measurements of samples taken from drilling cores from potential geologic media. Lagedrost, J.F.; Capps, W. (Fiber Materials, Inc., Biddeford, ME (USA)). Dec. 1983. 179p. NTIS, PC A06/MF A01; 1; File Number DE84004926. GPO Dep.
Illegibility Code
Abstract
Density, steady-state conductivity, enthalpy, specific heat, heat capacity, thermal diffusivity and linear thermal expansion were measured on 59 materials from core drill samples of several geologic media, including rock salt, basalt, and other associated rocks from 7 potential sites for nuclear waste isolation. The measurements were conducted from or near to room temperature up to 500°C, or to lower temperatures if limited by specimen cracking or fracturing. Ample documentation establishes the reliability of the property measurement methods and the accuracy of the results.


Author(s)
Title
Journal citation
Date of publication
15701 Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC). McKenna, K.F.; Rej, D.J.; Tuszewski, M. (Los Alamos National Lab., NM (USA)). Nuclear Fusion; 23: No. 10, 1319-1325 (Oct 1983).
Abstract
Zero-dimensional power balance calculations are performed for a quasi-static, purely Ohmically heated field-reversed configuration. Without compression, the constraint imposed by radial pressure balance limits the power input. Estimates of the energy loss from impurity line radiation as well as from classical and anomalous transport are given. Effects of cold puff gas injection are also investigated.

INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA)*. Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

• Corporate Author Index

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

5785 (BMI/ONWI-522) **Thermal property and density measurements of samples taken from drilling cores from potential geologic media.** Lagedrost, J.F.; Capps, W. **(Fiber Materials, Inc., Biddeford, ME (USA)).** Dec. 1983. 179p. NTIS File Number DE84004926. GPO Dep.

is indexed as:

Fiber Materials, Inc., Biddeford, ME (USA)

• Personal Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

Capps, W., *See* Lagedrost, J. F.
Lagedrost, J.F., Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R;US)
McKenna, K.F., Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9:15701 (J;US)
Rej, D.J., *See* McKenna, K.F.
Tuszewski, M., *See* McKenna, K.F.

• Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

SALT DEPOSITS
Density
Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R;US)
REVERSED-FIELD PINCH
Energy Balance
Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9: 15701 (J;AT)

• Contract Number Index

DOE technical report literature is indexed using contract numbers. This index contains the contract number with corresponding abstract and report numbers.

AC06-76RL01830	**Fiber Materials, Inc., Biddeford, ME (USA)**	
	9:5785	BMI/ONWI-522

• Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience. When a report is supplied under a File Number, that number is included in the availability statement. A file number–report number correlation is included for convenience.

BMI/ONWI-		
522	9:5785	NTIS, PC A09/MF A01. File Number DE84004926, Distribution Category MN-70

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Foreign Sources

CEA Centre d'Etudes de Saclay
GIF-sur Yvette Cedex, France

Fachinformationszentrum
Energie, Physik, Mathematik GmbH
Karlsruhe, Federal Republic of Germany

IEA Biomass Conversion Service
Dublin, Ireland

IEA Coal Research
Technical Information Service
London, England

International Atomic Energy Agency
International Nuclear Information System
Vienna, Austria

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Springfield, VA

National Institutes of Health
National Library of Medicine
Bethesda, MD

Plenum Publishing Corporation
New York, NY

University of Tennessee
Graduate School of Library and Information Sciences
Knoxville, TN

Communication concerning the editorial policy and content of *Energy Research Abstracts* should be addressed to the Editor, *Energy Research Abstracts,* Office of Scientific and Technical Information, P. O. Box 62, Oak Ridge, TN 37831.

SUBJECT CONTENTS (NUMERICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 293 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semi-monthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope definitions and limitations is available as DOE/TIC-4584-R5 from NTIS for $9.50.

01 COAL AND COAL PRODUCTS
- 04 Processing
- 05 By-Products
- 06 Properties
- 08 Waste Management
- 09 Environmental Aspects
- 10 Reserves and Exploration
- 20 Mining
- 30 Transport and Handling
- 40 Combustion
- 50 Marketing and Economics
- 60 Health and Safety
- 70 Legislation and Regulations

02 PETROLEUM
- 01 Reserves
- 02 Geology and Exploration
- 03 Drilling and Production
- 04 Processing
- 05 Products and By-Products
- 06 Health and Safety
- 07 Marketing and Economics
- 08 Waste Management
- 09 Environmental Aspects
- 10 Legislation and Regulation
- 20 Transport, Pipelines, and Handling
- 30 Properties
- 40 Storage
- 50 Combustion

03 NATURAL GAS
- 01 Reserves
- 02 Geology and Exploration
- 03 Drilling, Production, and Processing
- 04 Products and By-Products
- 05 Health and Safety
- 06 Marketing and Economics
- 07 Waste Management
- 08 Environmental Aspects
- 09 Artificial Stimulation
- 10 Legislation and Regulation
- 20 Transport, Pipelines, and Handling
- 30 Properties
- 40 Combustion
- 50 Storage

04 OIL SHALES AND TAR SANDS
- 01 Reserves and Exploration
- 02 Site Geology and Hydrology
- 03 Drilling, Fracturing, and Mining
- 04 Oil Production, Recovery, and Refining
- 05 Properties and Composition
- 06 Direct Uses and By-Products
- 07 Health and Safety
- 08 Marketing and Economics
- 09 Waste Research and Management
- 10 Environmental Aspects
- 20 Regulations

05 NUCLEAR FUELS
- 01 Reserves
- 02 Exploration
- 03 Mining
- 04 Feed Processing
- 05 Enrichment
- 06 By-Products
- 07 Fuels Production and Properties
- 08 Spent Fuels Reprocessing
- 09 Transport and Storage
- 10 Marketing and Economics
- 20 Waste Management
- 30 Environmental Aspects
- 40 Health and Safety
- 50 Regulations

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY
- 01 Physical Isotope Separation
- 02 Radiation Sources
- 03 Isotopic Power Supplies

08 HYDROGEN
- 01 Production
- 02 Storage
- 03 Transport
- 04 Marketing and Economics
- 05 Safety
- 06 Industrial and Commercial Use
- 07 By-Products
- 08 Properties
- 09 Environmental Aspects

09 OTHER SYNTHETIC AND NATURAL FUELS
- 01 Hydrocarbon Fuels
- 02 Alcohol Fuels
- 03 Inorganic Hydrogen Compound Fuels
- 04 Solid Waste and Wood Fuels
- 05 Liquid Waste Fuels
- 06 Gaseous Waste Fuels

13 HYDRO ENERGY
- 01 Resources and Availability
- 02 Site Geology and Meteorology
- 03 Plant Design and Operation
- 04 Regulations and Licensing
- 05 Economics and Management
- 06 Environmental Aspects
- 07 Power-Conversion Systems

14 SOLAR ENERGY
- 01 Resources and Availability
- 03 Economics
- 04 Environmental, Legal, and Institutional Aspects
- 05 Solar Energy Conversion
- 06 Photovoltaic Power Systems
- 07 Solar Thermal Power Systems
- 08 Ocean Energy Systems
- 09 Solar Thermal Utilization
- 10 Solar Collectors and Concentrators
- 20 Heat Storage

15 GEOTHERMAL ENERGY
- 01 Resource Status and Assessment
- 02 Geology and Hydrology of Geothermal Systems
- 03 Geothermal Exploration and Exploration Technology
- 04 Legal and Institutional Aspects
- 05 Economic and Financial Aspects
- 06 Environmental Aspects and Waste Disposal
- 07 By-Products
- 08 Geothermal Power Plants
- 09 Geothermal Engineering
- 10 Direct Energy Utilization
- 20 Geothermal Data and Theory

16 TIDAL AND WAVE POWER
- 03 Regulations
- 04 Economics

16 TIDAL AND WAVE POWER (CONT.)
- 05 Environmental Aspects
- 07 Tidal Power Plants
- 08 Wave Energy Converters

17 WIND ENERGY
- 01 Availability (Climatology)
- 03 Regulations
- 04 Economics
- 05 Environmental Aspects
- 06 Wind Energy Engineering

20 ELECTRIC POWER ENGINEERING
- 01 Power Plants and Power Generation
- 02 Environmental Control Technology
- 03 Power Transmission and Distribution

21 NUCLEAR POWER PLANTS
- 01 Power Reactors, Non-Breeding, Light-Water Moderated, Boiling Water Cooled
- 02 Power Reactors, Non-Breeding, Light-Water Moderated, Non-Boiling Water Cooled
- 03 Power Reactors, Non-Breeding, Graphite Moderated
- 04 Power Reactors, Non-Breeding, Otherwise Moderated or Unmoderated
- 05 Power Reactors, Breeding
- 06 Power Reactors, Auxiliary, Mobile, Package, and Transportable
- 07 Regulation and Licensing
- 08 Economics
- 09 Process Heat Reactors

22 NUCLEAR REACTOR TECHNOLOGY
- 01 Theory and Calculation
- 02 Components and Accessories
- 03 Fuel Elements
- 04 Control Systems
- 05 Environmental Aspects
- 06 Research, Test, and Experimental Reactors
- 07 Plutonium and Isotope Production Reactors
- 08 Propulsion Reactors
- 09 Reactor Safety

25 ENERGY STORAGE
- 01 Magnetic
- 02 Compressed Gas
- 03 Pumped Hydro
- 04 Capacitor Banks
- 05 Flywheels
- 06 Thermal
- 07 Liquefied Gas
- 08 Chemical
- 09 Batteries

29 ENERGY PLANNING AND POLICY
- 01 Energy Analysis and Modeling
- 02 Economics and Sociology
- 03 Environment, Health, and Safety
- 04 Natural Resources
- 05 Research, Development, Demonstration, and Commercialization
- 06 Nuclear Energy
- 07 Transport and Storage
- 08 Waste Heat Utilization
- 10 Conservation
- 20 Supply, Demand, and Forecasting
- 30 Policy, Legislation, and Regulation
- 40 Fossil Fuels
- 50 Hydrogen and Synthetic Fuels
- 60 Electric Power
- 80 Consumption and Utilization
- 90 Unconventional Sources and Power Generation

30 DIRECT ENERGY CONVERSION
- 01 MHD Generators
- 02 EHD Generators
- 03 Thermoelectric Generators
- 04 Thermionic Converters
- 05 Fuel Cells
- 08 Miscellaneous Converters

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION
- 01 Buildings
- 02 Transportation
- 03 Industry and Agriculture
- 06 Municipalities and Community Systems
- 09 Education and Public Relations

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS
- 01 Internal Combustion Engines
- 02 External Combustion Engines
- 03 Electric-Powered Systems
- 04 Hybrid Systems
- 05 Flywheel Propulsion
- 06 Vehicle Design Factors
- 07 Emission Control
- 08 Alternative Fuels

36 MATERIALS
- 01 Metals and Alloys
- 02 Ceramics, Cermets, and Refractories
- 03 Composite Materials
- 04 Polymers and Plastics
- 06 Other Materials

40 CHEMISTRY
- 01 Analytical and Separations Chemistry
- 02 Inorganic and Physical Chemistry
- 03 Organic Chemistry
- 04 Electrochemistry
- 05 Photochemistry
- 06 Radiation Chemistry
- 07 Radiochemistry and Nuclear Chemistry
- 08 Combustion Pyrolysis, and High-Temperature Chemistry

42 ENGINEERING
- 01 General Engineering
- 02 Facilities and Equipment
- 03 Lasers
- 04 Heat Transfer and Fluid Flow
- 05 Materials Testing
- 06 Safety Engineering
- 07 Vacuum Engineering
- 08 Electronic Circuits and Devices
- 09 Waste Processing Plants and Equipment
- 10 Combustion Systems
- 20 Underground Engineering
- 30 Marine Engineering
- 40 Pollution Control Equipment
- 50 Power Cycles

43 PARTICLE ACCELERATORS
- 01 Design, Development, and Operation
- 02 Beam Dynamics, Field Calculations, and Ion Optics
- 03 Auxiliaries and Components
- 04 Storage Rings

44 INSTRUMENTATION
- 01 Radiation Instrumentation
- 02 Radiation Effects on Instrument Components, Instruments, or Electronic Systems
- 03 Miscellaneous Instruments
- 04 Well Logging Instrumentation

45 EXPLOSIONS AND EXPLOSIVES
- 01 Chemical
- 02 Nuclear
- 03 Explosion Detection

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 04 Thermal Effluents Monitoring and Transport
- 05 Site Resource and Use Studies
- 06 Regulations

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 04 Thermal Effluents Monitoring and Transport
- 05 Site Resource and Use Studies
- 06 Regulations

52 ENVIRONMENTAL SCIENCES, AQUATIC
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 04 Thermal Effluents Monitoring and Transport
- 05 Site Resource and Use Studies
- 06 Regulations

53 ENVIRONMENTAL—SOCIAL ASPECTS OF ENERGY TECHNOLOGIES
- 01 Social and Economic Studies
- 02 Assessment of Energy Technologies
- 03 Environmental Impact Statements

55 BIOMEDICAL SCIENCES, BASIC STUDIES
- 01 Behavioral Biology
- 02 Biochemistry
- 03 Cytology
- 04 Genetics

55 BIOMEDICAL SCIENCES, BASIC STUDIES (CONT.)
05 Metabolism
06 Medicine
07 Microbiology
08 Morphology
09 Pathology
10 Physiological Systems
20 Public Health
30 Agriculture and Food Technology

56 BIOMEDICAL SCIENCES, APPLIED STUDIES
01 Radiation Effects
02 Thermal Effects
03 Chemicals Metabolism and Toxicology
04 Other Environmental Pollutant Effects

57 HEALTH AND SAFETY

58 GEOSCIENCES
01 Geology and Hydrology
02 Geophysics
03 Mineralogy, Petrology, and Rock Mechanics
04 Geochemistry
05 Oceanography

64 PHYSICS I
01 Astrophysics and Cosmology
02 Atmospheric Physics
03 Atomic, Molecular, and Chemical Physics
04 Fluid Physics
50 High Energy Physics

65 PHYSICS II
10 Nuclear Physics
40 Radiation and Shielding Physics
50 Medical Physics
60 Solid-State Physics
61 Superconductivity
70 Theoretical Physics
80 Mathematical Physics
90 Communication, Education, History, and Philosophy

70 FUSION ENERGY
01 Plasma Research
02 Fusion Power Plant Technology

99 GENERAL AND MISCELLANEOUS
01 Management
02 Mathematics and Computers
03 Information Handling
04 Law
05 Civilian Defense

CORPORATE AUTHOR INDEX

PERSONAL AUTHOR INDEX

SUBJECT INDEX

CONTRACT NUMBER INDEX

REPORT NUMBER INDEX

FILE NUMBER CORRELATION

SUBJECT CONTENTS (ALPHABETICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 293 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope definitions and limitations is available as DOE/TIC-4584-R5 from NTIS for $9.50.

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS
- 08 Alternative Fuels
- 03 Electric-Powered Systems
- 07 Emission Control
- 02 External Combustion Engines
- 05 Flywheel Propulsion
- 04 Hybrid Systems
- 01 Internal Combustion Engines
- 06 Vehicle Design Factors

56 BIOMEDICAL SCIENCES, APPLIED STUDIES
- 03 Chemicals Metabolism and Toxicology
- 04 Other Environmental Pollutant Effects
- 01 Radiation Effects
- 02 Thermal Effects

55 BIOMEDICAL SCIENCES, BASIC STUDIES
- 30 Agriculture and Food Technology
- 01 Behavioral Biology
- 02 Biochemistry
- 03 Cytology
- 04 Genetics
- 06 Medicine
- 05 Metabolism
- 07 Microbiology
- 08 Morphology
- 09 Pathology
- 10 Physiological Systems
- 20 Public Health

40 CHEMISTRY
- 01 Analytical and Separations Chemistry
- 08 Combustion Pyrolysis, and High-Temperature Chemistry
- 04 Electrochemistry
- 02 Inorganic and Physical Chemistry
- 03 Organic Chemistry
- 05 Photochemistry
- 06 Radiation Chemistry
- 07 Radiochemistry and Nuclear Chemistry

01 COAL AND COAL PRODUCTS
- 05 By-Products
- 40 Combustion
- 09 Environmental Aspects
- 60 Health and Safety
- 70 Legislation and Regulations
- 50 Marketing and Economics
- 20 Mining
- 04 Processing
- 06 Properties
- 10 Reserves and Exploration
- 30 Transport and Handling
- 08 Waste Management

30 DIRECT ENERGY CONVERSION
- 02 EHD Generators
- 05 Fuel Cells
- 01 MHD Generators
- 08 Miscellaneous Converters
- 04 Thermionic Converters
- 03 Thermoelectric Generators

20 ELECTRIC POWER ENGINEERING
- 02 Environmental Control Technology
- 01 Power Plants and Power Generation
- 03 Power Transmission and Distribution

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION
- 01 Buildings
- 09 Education and Public Relations
- 03 Industry and Agriculture
- 06 Municipalities and Community Systems
- 02 Transportation

29 ENERGY PLANNING AND POLICY
- 10 Conservation
- 80 Consumption and Utilization
- 02 Economics and Sociology
- 60 Electric Power
- 01 Energy Analysis and Modeling
- 03 Environment, Health, and Safety
- 40 Fossil Fuels
- 50 Hydrogen and Synthetic Fuels
- 04 Natural Resources
- 06 Nuclear Energy
- 30 Policy, Legislation, and Regulation
- 05 Research, Development, Demonstration, and Commercialization
- 20 Supply, Demand, and Forecasting
- 07 Transport and Storage
- 90 Unconventional Sources and Power Generation
- 08 Waste Heat Utilization

25 ENERGY STORAGE
- 09 Batteries
- 04 Capacitor Banks
- 08 Chemical
- 02 Compressed Gas
- 05 Flywheels
- 07 Liquefied Gas
- 01 Magnetic
- 03 Pumped Hydro
- 06 Thermal

42 ENGINEERING
- 10 Combustion Systems
- 08 Electronic Circuits and Devices
- 02 Facilities and Equipment
- 01 General Engineering
- 04 Heat Transfer and Fluid Flow
- 03 Lasers
- 30 Marine Engineering
- 05 Materials Testing
- 40 Pollution Control Equipment
- 50 Power Cycles
- 06 Safety Engineering
- 20 Underground Engineering
- 07 Vacuum Engineering
- 09 Waste Processing Plants and Equipment

52 ENVIRONMENTAL SCIENCES, AQUATIC
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport

52 ENVIRONMENTAL SCIENCES, AQUATIC (CONT.)
- 06 Regulations
- 05 Site Resource and Use Studies
- 04 Thermal Effluents Monitoring and Transport

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 06 Regulations
- 05 Site Resource and Use Studies
- 04 Thermal Effluents Monitoring and Transport

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL
- 01 Basic Studies
- 02 Chemicals Monitoring and Transport
- 03 Radioactive Materials Monitoring and Transport
- 06 Regulations
- 05 Site Resource and Use Studies
- 04 Thermal Effluents Monitoring and Transport

53 ENVIRONMENTAL—SOCIAL ASPECTS OF ENERGY TECHNOLOGIES
- 02 Assessment of Energy Technologies
- 03 Environmental Impact Statements
- 01 Social and Economic Studies

45 EXPLOSIONS AND EXPLOSIVES
- 01 Chemical
- 03 Explosion Detection
- 02 Nuclear

70 FUSION ENERGY
- 02 Fusion Power Plant Technology
- 01 Plasma Research

99 GENERAL AND MISCELLANEOUS
- 05 Civilian Defense
- 03 Information Handling
- 04 Law
- 01 Management
- 02 Mathematics and Computers

58 GEOSCIENCES
- 04 Geochemistry
- 01 Geology and Hydrology
- 02 Geophysics
- 03 Mineralogy, Petrology, and Rock Mechanics
- 05 Oceanography

15 GEOTHERMAL ENERGY
- 07 By-Products
- 10 Direct Energy Utilization
- 05 Economic and Financial Aspects
- 06 Environmental Aspects and Waste Disposal
- 02 Geology and Hydrology of Geothermal Systems
- 20 Geothermal Data and Theory
- 09 Geothermal Engineering
- 03 Geothermal Exploration and Exploration Technology
- 08 Geothermal Power Plants
- 04 Legal and Institutional Aspects
- 01 Resource Status and Assessment

57 HEALTH AND SAFETY

13 HYDRO ENERGY
- 05 Economics and Management
- 06 Environmental Aspects
- 03 Plant Design and Operation
- 07 Power-Conversion Systems
- 04 Regulations and Licensing
- 01 Resources and Availability
- 02 Site Geology and Meteorology

08 HYDROGEN
- 07 By-Products
- 09 Environmental Aspects
- 06 Industrial and Commercial Use
- 04 Marketing and Economics
- 01 Production
- 08 Properties
- 05 Safety
- 02 Storage
- 03 Transport

44 INSTRUMENTATION
- 03 Miscellaneous Instruments
- 02 Radiation Effects on Instrument Components, Instruments, or Electronic Systems
- 01 Radiation Instrumentation
- 04 Well Logging Instrumentation

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY
- 03 Isotopic Power Supplies
- 01 Physical Isotope Separation
- 02 Radiation Sources

36 MATERIALS
- 02 Ceramics, Cermets, and Refractories
- 03 Composite Materials
- 01 Metals and Alloys
- 06 Other Materials
- 04 Polymers and Plastics

03 NATURAL GAS
- 09 Artificial Stimulation
- 40 Combustion
- 03 Drilling, Production, and Processing
- 08 Environmental Aspects
- 02 Geology and Exploration
- 05 Health and Safety
- 10 Legislation and Regulation
- 06 Marketing and Economics
- 04 Products and By-Products
- 30 Properties
- 01 Reserves
- 50 Storage
- 20 Transport, Pipelines, and Handling
- 07 Waste Management

05 NUCLEAR FUELS
- 06 By-Products
- 05 Enrichment
- 30 Environmental Aspects
- 02 Exploration
- 04 Feed Processing
- 07 Fuels Production and Properties
- 40 Health and Safety
- 10 Marketing and Economics
- 03 Mining
- 50 Regulations
- 01 Reserves
- 08 Spent Fuels Reprocessing
- 09 Transport and Storage
- 20 Waste Management

21 NUCLEAR POWER PLANTS
- 08 Economics
- 06 Power Reactors, Auxiliary, Mobile, Package, and Transportable
- 05 Power Reactors, Breeding
- 03 Power Reactors, Non-Breeding, Graphite Moderated
- 01 Power Reactors, Non-Breeding, Light-Water Moderated, Boiling Water Cooled
- 02 Power Reactors, Non-Breeding, Light-Water Moderated, Non-Boiling Water Cooled
- 04 Power Reactors, Non-Breeding, Otherwise Moderated or Unmoderated
- 09 Process Heat Reactors
- 07 Regulation and Licensing

22 NUCLEAR REACTOR TECHNOLOGY
- 02 Components and Accessories
- 04 Control Systems
- 05 Environmental Aspects
- 03 Fuel Elements
- 07 Plutonium and Isotope Production Reactors
- 08 Propulsion Reactors
- 09 Reactor Safety
- 06 Research, Test, and Experimental Reactors
- 01 Theory and Calculation

04 OIL SHALES AND TAR SANDS
- 06 Direct Uses and By-Products
- 03 Drilling, Fracturing, and Mining
- 10 Environmental Aspects
- 07 Health and Safety
- 08 Marketing and Economics
- 04 Oil Production, Recovery, and Refining
- 05 Properties and Composition
- 20 Regulations
- 01 Reserves and Exploration
- 02 Site Geology and Hydrology
- 09 Waste Research and Management

09 OTHER SYNTHETIC AND NATURAL FUELS
- 02 Alcohol Fuels
- 06 Gaseous Waste Fuels
- 01 Hydrocarbon Fuels
- 03 Inorganic Hydrogen Compound Fuels
- 05 Liquid Waste Fuels
- 04 Solid Waste and Wood Fuels

43 PARTICLE ACCELERATORS
- 03 Auxiliaries and Components
- 02 Beam Dynamics, Field Calculations, and Ion Optics
- 01 Design, Development, and Operation
- 04 Storage Rings

02 PETROLEUM
- 50 Combustion
- 03 Drilling and Production
- 09 Environmental Aspects
- 02 Geology and Exploration

02 PETROLEUM (CONT.)
06 Health and Safety
10 Legislation and Regulation
07 Marketing and Economics
04 Processing
05 Products and By-Products
30 Properties
01 Reserves
40 Storage
20 Transport, Pipelines, and Handling
08 Waste Management

64 PHYSICS I
01 Astrophysics and Cosmology
02 Atmospheric Physics
03 Atomic, Molecular, and Chemical Physics
04 Fluid Physics
50 High Energy Physics

65 PHYSICS II
90 Communication, Education, History, and Philosophy
80 Mathematical Physics
50 Medical Physics
10 Nuclear Physics
40 Radiation and Shielding Physics
60 Solid-State Physics
61 Superconductivity
70 Theoretical Physics

14 SOLAR ENERGY
03 Economics
04 Environmental, Legal, and Institutional Aspects
20 Heat Storage
08 Ocean Energy Systems
06 Photovoltaic Power Systems
01 Resources and Availability
10 Solar Collectors and Concentrators
05 Solar Energy Conversion
07 Solar Thermal Power Systems
09 Solar Thermal Utilization

16 TIDAL AND WAVE POWER
04 Economics
05 Environmental Aspects
03 Regulations
07 Tidal Power Plants
08 Wave Energy Converters

17 WIND ENERGY
01 Availability (Climatology)
04 Economics
05 Environmental Aspects
03 Regulations
06 Wind Energy Engineering

CORPORATE AUTHOR INDEX

PERSONAL AUTHOR INDEX

SUBJECT INDEX

CONTRACT NUMBER INDEX

REPORT NUMBER INDEX

FILE NUMBER CORRELATION

ENERGY RESEARCH ABSTRACTS

01 COAL AND COAL PRODUCTS

REFER ALSO TO CITATION(S) 01000011215

0104 Processing

REFER ALSO TO CITATION(S) 01040010859, 10860, 10860, 10860, 10861, 10862

10829 (CONF-841121—12) Role of pilot plants in the development of U-Gas commercial reactor design. Patel, J.G.; Wheeler, G.F. (Institute of Gas Technology, Chicago, IL (USA); USDOE, Washington, DC). 1984. 27p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85005075.

From AIChE annual meeting; San Francisco, CA, USA (25 Nov 1984).

The U-GAS pilot plant and the cold-model pilot plant have played critical roles in the design of the commercial gasifier for the U-GAS process. The pilot plants provided information for (1) verifying the suitability of the candidate coal feedstock for the process, (2) the process design basis for the gasifier, (3) the mechanical design of certain internal parts of the gasifier, and (4) the scale-up of grid/venturi area of the gasifier. 7 figures, 7 tables.

10830 (DOE/ET/10137—T11) Gasification of residual materials from coal liquefaction. Final report. Child, C.A.; Robin, A.M. (Texaco, Inc., Montebello, CA (USA). Montebello Research Lab.). Aug 1984. Contract AC01-76ET10137. 28p. (FE—2247-37). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85004310.

During the years 1977 through 1984, laboratory and pilot plant evaluations were made at Texaco's Montebello Research Laboratory to determine the suitability of various residual materials from DOE sponsored coal liquefaction projects as feedstocks for the Texaco Gasification Process. Fourteen laboratory evaluations, eight preliminary pilot plant evaluations, four extended pilot plant evaluations and one sustained pilot plant evaluation were completed with coal liquefaction residues from seven different processes. Operating pressures from 350 psig to 1200 psig were demonstrated. Most of the residues may be fed to a Texaco gasifier either as a molten fluid or as a slurry of ground solids in water. Some of the residues, such as the Rocketdyne char and the SRC-1 mineral ash residue from the Kerr McGee solvent deashing process, can be fed to a Texaco gasifier only as a water slurry. The extended and sustained pilot plant evaluations demonstrated that SRC-II and H-Coal liquefaction residues may be efficiently gasified as molten fluids. The extruded form of the SRC-I mineral ash residue from the Kerr McGee solvent deashing process was a suitable feedstock when fed to the gasifier as a water slurry. Exxon EDS residue was difficult to handle in the pilot plant as a molten fluid because of its high viscosity and thermal instability. However, it is a suitable feedstock when fed to the gasifier as a water slurry. The slurry feed system was easier to operate than the molten feed system, however the gasifier operated more efficiently on molten feed. 3 figures, 5 tables.

10831 (DOE/FE/60339—T7) High-sulfur coal research at the SIUC Coal Technology Center. Quarterly report, July 1-September 30, 1984. (Southern Illinois Univ., Carbondale (USA). Coal Extraction and Utilization Research Center). 26 Oct 1984. Contract FC22-83FE60339. 74p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85000035.

The overall objective of the research effort addressed in this cooperative agreement is to expand the technology aimed at increasing the use of high-sulfur coal in an environmentally acceptable manner. This year's work includes four new projects: one in coal science, two in coal conversion, and one in coal utilization. These are combined with ten ongoing projects for a total of fourteen research projects summarized in this report. With regard to the central operation of the Coal Technology Laboratory, there are now ten operational laboratories, and two more are near completion. It is anticipated that by the middle of the next quarter that the gas chromatograph mass spectrometer will have been installed and an operator hired. The fluidized bed combustor has already been installed and is in the process of being inspected by a factory representative. It too should be fully operational by the middle of next quarter. Progress continues to be made on the research in the four areas of coal science, coal preparation, coal conversion, and coal utilization. Fourteen items have been entered individually into EDB and ERA.

10832 (DOE/FE/60339—T7, pp 43-48) Extraction and desulfurization of chemically degraded coal with supercritical fluids. Chen, J.W.; Muchmore, C.B.; Kent, A.C. 26 Oct 1984. NTIS, PC A04/MF A01. File Number DE85000035.

In High-sulfur coal research at the SIUC Coal Technology Center. Quarterly report, July 1-September 30, 1984.

The research objectives were: (1) to continue the study of the effect of chemical treatment on supercritical extractability of coal; (2) to compare desulfurization potential and supercritical extractability of coal with different solvents and with mixed solvents; (3) to continue utilization of column separation techniques for isolating and identifying constituents in the liquid product; and (4) to determine and correct mechanical and processing problems in the continuous reactor system. Progress is being made toward accomplishment of the overall project objective: establishment of kinetic relationships between the desulfurization potential of supercritical extraction and coal characteistics. Desulfurization response to pretreatment with a KOH/alcohol solution prior to supercritical extraction was evaluated for methyl and ethyl alcohols, utilizing the semi-continuous reactor system. A potassium balance indicated low retention of potassium in the coal following pretreatment. The batch reactor system was utilized to investigate the mixed solvent systems. The results demonstrated that an improvement of desulfurization did take place by mixing tetralin into the alcohol solvent. The mechanical testing of the continuous reactor system is continuing. In the preliminary runs at a moderate temperature and pressure (300°C, 1200 psi), the process performance for desulfurization was comparable to batch experiments with the same coal under similar reaction conditions.

10833 (DOE/FE/60339—T7, pp 56-57) Study of desulfurization by high-temperature leaching with chemical addition. Chen, H.L. 26 Oct 1984. NTIS, PC A04/MF A01. File Number DE85000035.

In High-sulfur coal research at the SIUC Coal Technology Center. Quarterly report, July 1-September 30, 1984.

This research examines the desulfurization of coal by use of a high-temperature leaching technique with chemical additives. In the initial phase of the research, Illinois NO. 6 coal will be leached by $CuCl_2$ solutions at various concentrations and at different temperatures. The research objectives are these: (1) to set up a reactor system for high-temperature leaching; (2) to conduct preliminary experiments; and (3) to modify the experimental system if it is necessary. A Benco reactor which can operate at 450°C and 75 psia has already been adapted for the experimentation. A reflux condenser was constructed to assure that all the condensable vapors were returned to the reactor during the course of reaction. The heating elements and temperatue controller were also tested. A test sample of high-sulfur coal was leached with and without $CuCl_2$ addition at 100°C. Results indicated a reduction in sulfur.

10834 (DOE/FE/60339—T7, pp 58-59) **Removal of organic sulfur from microbial coal (bacterial degradation of sulfur containing heterocyclic compounds).** Klubek, B.; Clark, D. 26 Oct 1984. NTIS, PC A04/MF A01. File Number DE85000035.

In High-sulfur coal research at the SIUC Coal Technology Center. Quarterly report, July 1-September 30, 1984.

Sulfur in coal is a major source of air pollution, and considerable efforts are being made to devise cost-effective ways of removing the sulfur. One promising method is the microbial desulfurization of coal. Recent research has shown that it is possible to remove almost all of the inorganic sulfur from coal using the bacteria Thiobacillus or Sulfolobus. These organisms convert sulfide to sulfate but leave the organic sulfur untouched. Since certain coals, including those in the Illinois Basin, contain high levels of organic sulfur, its removal is also necessary. If a strain of bacteria could be found or developed which would effectively remove organic sulfur from coal, then, when used in conjunction with an organism which removes inorganic sulfur, this could result in an effective desulfurization method. Alternate approaches will also be used in developing bacteria which remove organic sulfur. One method is to isolate suitable naturally occurring bacterial species, and the other is to mutate a laboratory species, Escherichia coli, an organism which is genetically well understood and whose pathways for the metabolism of sulfur-containing amino acids have been extensively investigated. A site has been located where dibenzothiophene oxidizing bacteria are likley to be found. The site has previously been used to study the treatment of coal refuse with sewage sludge.

10835 (DOE/MC/14615—T1) **Characterization of high temperature vapors of import to combustion and gasification processes in the energy technologies. Final report, March 1, 1980-March 1, 1981.** Gole, J.L. (Georgia Inst. of Tech., Atlanta (USA). School of Chemistry). 1981. Contract AC21-80MC14615. 92p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85005275.

Low tolerance levels for certain species in process streams impose stronger requirements for reliable thermodynamic and kinetic data in order to predict low level species concentrations. In addition, there must be serious concern focused on whether or not these systems are best represented via equilibrium or non-equilibrium models. We have been concerned with the characterization of important processes in these inherently high temperature systems through application of chemiluminescent and laser fluorescent techniques to the determination of bond energies, spectroscopic constants, and rapid energy transfer processes. Our focus has been on the monohydroxides of sodium and potassium and the oxides and sulfides of select metals including SiO, SiS, Na_2O, and NaO. We have investigated the non-equilibrium routes for the formation of these compounds and have carried out some kinetic parameterization. In addition, we have been engaged in the study of rapid energy transfer routes among the electronic states of high temperature molecules. Thus far these studies have indicated that both V-E and E-E energy transfer can occur at rates which may approach 500 times the calculated gas kinetic rate. These surprising results demonstrate that vibrationally and/or electronically excited high temperature molecules act as if they were large and diffuse entities capable of significant interaction at very long range. The rapid energy transfer is a general phenomenon and effects have been observed in several molecules including SiO and KOH. The observation of such rapid energy transfer has significant implications for the modeling of energy generating systems and the characterization of heat flow in these systems. The nature of the rapid energy transfer means that both kinetic reaction rate data and energy transfer data must be included in order to obtain a realistic modeling of an energy generating system.

10836 (DOE/OR/03054—108) **Existing technology transfer report dissolver cold-flow modelling.** Mehta, M.V. (International Coal Refining Co., Allentown, PA (USA); Air Products and Chemicals, Inc., Allentown, PA (USA)). Jun 1984. Contract AC05-78OR03054. 207p. NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE85001632.

Air Products and Chemicals, Inc. conducted a detailed study in support of the dissolver design for the SRC-I Demonstration Plant. This more than 2-year long study of the three-phase flow hydrodynamics was carried out in a systematic fashion using cold-flow modelling techniques. Almost all the tests were performed at room temperature and pressure, and the visual observation of the test section played a significant role in the data analysis and provided a valuable explanation of observed deviations. The cold-flow modelling studies were carried out in 2-in. and 5-in. internal diameter (i.d.) Plexiglas columns. Various combinations of gas, liquids, and solids were used to simulate the process fluids in the actual dissolver as much as was practical. In all cases, experiments were initiated by performing two-phase (gas/liquid) flow tests to ensure that the experimental techniques were adequate to reproduce existing data. The cold-flow dissolver modelling was begun in a 2-in.-diam Plexiglas column by simulating the operation of a Coal Process Development Unit (CPDU) reactor. The CPDU is a laboratory scale SRC pilot plant at Air Products' facilities in Trexlertown, PA. Another objective of this study was to develop a reactor model that could be used to predict axial dispersion coefficients and solids concentration profiles in the reactor. This model was continuously modified based on the latest available data from a larger, 5-in.-diam Plexiglas column. The gas holdup, solids buildup, and particle size distribution in the column were also studied in detail. This report summarizes the work performed and pertinent results obtained from the cold-flow dissolver modelling studies. It also briefly describes subsequent tasks and studies undertaken to support the SRC-I Demonstration Plant dissolver design.

10837 (DOE/OR/03054—121) **6000 tpd SRC-I Demonstration Plant: Plant Availability Study and Utilization Model non-proprietary version.** (Kellogg Rust Synfuels, Inc., Houston, TX (USA)). Jun 1984. Contract AC05-78OR03054. 318p. NTIS, PC A14/MF A01; 1; GPO Dep. File Number DE85004933.

This report documents the SRC-I Plant Availability Study and Utilization Model developed by Kellogg Rust Synfuels, Inc. and ICRC's use of the program as presented in the Report Overview. This overview reflects the experience and expertise of ICRC, including detailed knowledge of the expected capacities and availabilities for individual units of the facility. Using the ICRC data and the Kellogg model, results in an overall Plant Utilization Factor in excess of 90% being achieved within 4 years of operation. This is higher than predicted for the Baseline (71%) and also better than the test case shown in the Kellogg section of this report (56%). The overall results illustrate that the SRC area availability has a significant influence on the Plant Utilization Factor. The program can serve as a powerful tool for optimizing the plant design.

10838 (DOE/OR/03054—T24) **Process R and D plan: Post-Baseline Research and Technology Subcontract Programs (Task 203).** (International Coal Refining Co., Allentown, PA (USA)). 1983. Contract AC05-78OR03054. 27p. NTIS, PC A03. File Number DE85001616.

This Process R and D Plan defines Task 203 - Research and Technology Subcontract Programs - to be carried out as part of the ICRC Post Baseline Activities set forth in Letter No. ICRC/DOE-1777. Budgets and schedules for the programs in this task as well as a procedure for cost accounting, were also presented in this reference letter. The budgeted cost of each program is the contract price less any cost accruals before July 1, 1982 - the beginning of the Post Baseline Activity period. For the two programs without contracts i, place on July 1, 1981 (16.2, 22.4), the budgeted cost reflects the initial response to the request for proposal. The Task 203 programs fall into three categories: (1) Two Stage Liquefaction Process Support, (2) Product Characterization, and (3) Thermophysical Property Measurement. Each program description includes the classification, performing organization, background, justification, and task description of the work to be performed. A final report will be issued upon the completion of each program. Table I summarizes the programs and budgeted costs for Task 203 - Post Baseline Research and Technology Subcontract Programs.

10839 (DOE/OR/03054—T37-Vol.1) **Design basis memorandum. Volume 1. Nonproprietary version.** (International Coal Refining Co., Allentown, PA (USA)). Jul 1984. Contract AC05-78OR03054. 546p. NTIS, PC A23/MF A01; 1; GPO Dep. File Number DE85001562.

The conditions and criteria set forth here shall be followed in developing the process design for the SRC Process Area of the SRC-I Demonstration Plant. Since certain areas may require further definition, this document will be updated by the Purchaser and approved by the Department of Energy (DOE) as the process design proceeds and new information becomes available. The responsibility for this document is borne by the Purchaser, the International Coal Refining Company (ICRC). The Contractor is expected to review the document and bring to the attention of the Purchaser any portions of the document which conflict with the Contractor's engineering judgment. Changes and/or additions to the document may be initiated by the Purchaser, the Contractor, or the DOE. The SRC-I Demonstration Plant is funded substantially by the federal government for the purpose of demonstrating the technical feasibility, the economic feasibility, and the environmental acceptability of the SRC-I process. This demonstration will enable an industry based on the SRC-I process to be established in the private sector with no additional experimental or demonstration work, assuming that high sulfur (Eastern) agglomerating coal is used as feedstock.

10840 **(DOE/OR/20992—T1) Testing of refractories in co-containing coal gasification atmospheres. Final report.** Clancy, T.; Heystek, H. (Bureau of Mines, Tuscaloosa, AL (USA). Tuscaloosa Research Center). Mar 1983. Contract AI05-82OR20992. 14p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85006097.

Based on test data obtained on refractory samples exposed for 1000 hours to three steam-containing high-Btu atmospheres of different compositions at 500° C and 1000 psig it would appear that for the conditions tested commercial intermediate alumina insulating or dense refractory concretes would perform adequately as linings for dry-ash coal gasifiers. CO disintegration was not observed in commercial refractories reported to contain Fe_2O_3 exposed to a high-Btu gas composition containing CO whether or not NH_3 and H_2S were present. In the 90 pct alumina dense concrete with a 0.1 pct iron (as Fe) powder addition it was found that the strength and abrasion resistance were adversely affected by the presence of CO, but only when NH_3 and H_2S were not present. The presence of H_2S in a gas composition appear to retard or prevent CO disintegration of refractories containing additions of iron or iron oxide. Strength and abrasion resistance increases were noted for intermediate alumina castables exposed to the high-Btu atmospheres when compared to air exposures. Decreases in strength values occurred for the high alumina materials. This is characteristic of the results obtained in earlier studies of refractories following similar exposures at temperatures of 730° to 1100° C. 6 figures.

10841 **(DOE/PC/50053—T6) Interview write-ups supporting the feasibility analysis for data base design.** (Orkand Corp., Silver Spring, MD (USA)). 31 Jan 1983. Contract AC22-82PC50053. 42p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85005209.

This report consists of interviews with 23 people by Orkand Corp. interviewers on the Coal Liquefaction Technology Data Base under development by the Pittsburgh Energy Technology Center. Orkand was under contract to PETC. The people interviewed were from DOE/OFE, DOE/TIC, METC, GAO, SFC, ICRC, Ashland Oil, Fluor Corp., Dept. of Commerce, TERA Corp., National Council on Synthetic Fuels Production and the House Committee on Energy Development and Affiliations. The contributions mainly involved what information was needed and who needed it, especially the need of the contracted organizations. There were a few negative comments, based mainly on the lack of proprietary data in the data base, the fact that it could not have more information than the contracting companies already had, that seasoned engineers familiar with coal liquefaction should abstract the material, etc. (LTN)

10842 **(DOE/PC/63032—T5) Bench scale development of the TRW process for cleaning coal (gravimelt process). Quarterly technical progress report, August-October 1984.** (TRW, Inc., Redondo Beach, CA (USA)). 23 Nov 1984. Contract AC22-83PC63032. 24p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004377.

Important progress has been made in all of the mojor process unit operations of the Gravimelt Process. Beginning with data that shows that molten caustic size reduces (comminuates) 3/8" top size coal to a size giving excellent desulfurization and demineralization rates, including material balance results for operation of the 20 lb/hr leacher on Kentucky No. 11 coal and also including countercurrent molten caustic washing at the 20 lb/hr rate of Gravimelt reacted coal resulting in a product Pittsburgh No. 8 coal which is similar in ash and sulfur to a No. 2 fuel oil. In addition, laboratory scale demonstration of caustic regeneration by two different routes has been accomplished. An additional coal for the program was received from the Ames Laboratory which has high organic sulfur. This coal was tested at laboratory scale, to provide information prior to testing at bench scale, in which it is shown that this coal can be reduced in sulfur content to a value 1/3 lower than required by the New Source Performance Standards and the ash can be reduced to below 0.1%. 2 figures, 11 tables.

10843 **(DOE/RL/01830—T31) Development of an advanced water-gas shift conversion system. Monthly project status report No. 8, December 1-December 31, 1984.** Sealock, L.J. Jr.; Elliott, D.C.; Butner, R.S. (Battelle Pacific Northwest Labs., Richland, WA (USA)). 1984. Contract AC06-76RL01830. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85004847.

The work performed during the month of December focused on two different aspects of the project. First, efforts were made to bring a gas-driven compressor on-line in the system so that higher pressure experiments could be performed. This high pressure capacity is needed to facilitate the higher temperature experiments planned for January. Previous efforts to operate the compressor have been frustrated by problems with the air supply which powers the unit. These problems have been rectified. Secondly, experiments were performed using the feed gas preheater, which was discussed in the last monthly report. Several short runs were made using a mixed gas similar in composition to that which might exit a coal gasifier. The gas was chosen because it allows the operation of the preheater without the severe carbon deposition which had been observed with pure CO. The preheater was installed in order to test a suggestion that reaction rates in the water-gas shift reactor might be increased by introducing a hot feed gas (450°C) into a cooler, lower pressure catalytic quench tank (200°C), 650 psig). While the reaction rate was increased significantly over the expected values for a cool gas feed, the rate only increased to a range equivalent to that seen earlier at ~ 300°C and 1500 psig.

10844 **(DOE/TIC—3401) In-situ coal gasification: a bibliography.** Grissom, M.C. (ed.). (USDOE Office of Scientific and Technical Information, Oak Ridge, TN). Nov 1984. 521p. NTIS, PC A22/MF A01. File Number DE83015291.

The 2222 references in this bibliography on in-situ gasification of coal were selected from the Energy Data Base (EDB) produced by the Office of Scientific and Technical Information (OSTI). New citations on this subject are announced semimonthly in the bulletin Coal-Based Synfuels and monthly in Fossil Energy Update, both published by OSTI. The Energy Data Base is available for on-line searching using the DOE/RECON system or the DIALOG commercial on-line retrieval system. Abstracts in this bibliography are sorted first by year of publication and then by first author. Five indexes are provided: Corporate Author, Personal Author, Subject, Contract Number, and Report Number.

10845 **(NERDDP-EG—82-86) Electrostatic precipitation research part A: electrical properties.** Baker, J.W.; Smith, P.D.; Sullivan, K.M. (National Energy Research, Development and Demonstration Council, Canberra (Australia)). 1982. 73p. National Energy Research, Development and Demonstration Council, Canberra, Australia.

The specific aim of this project was to develop a laboratory corona apparatus which could produce repeatable corona characteristics from small samples of fly ash from coal. Ten different power station fly ashes were obtained for the test program. Pilot precipitator test data were available for five of these ashes. All the fly ash samples were characterised for other laboratory properties, including resistivity. The laboratory corona characteristics produced in the apparatus are sensitive to the fly ash that is being tested, at the range of current densities over which the electrostatic

precipitators at coal fired power stations operate. They are also similar in form to those that are produced in a large scale pilot electrostatic precipitator. The characteristics are able to currently rank fly ashes in terms of their collection efficiencies in a pilot electrostatic precipitator after correction for factors other than electrical limitations. Correlation exists between breakdown current densities calculated from resistivity results and corona characteristics. High resistivities and low breakdown current densities generally corresponded to low knee current densities.

10846 (NERDDP-EG—83-105) Carbonising properties of Australian coals and blends. Cudmore, J.F.; Burke, L.O.; Roberts, O.C. (National Energy Research, Development and Demonstration Council, Canberra (Australia)). 1982. 397p. National Energy Research, Development and Demonstration Council, Canberra, Australia.

An objective of this project has been to acquire more knowledge about the carbonising properties of Australian coals and blends and thus to provide technical support for the export coking coal industry. Selected Australian coals and blends were carbonised using experimental test coke ovens. Data on physical strength and reactivity of the cokes produced supplement earlier information on the quality of Australian coals of coking potential published by the Joint Coal Board and the Queensland Coal Board. Densified 'stamped' charging was shown to be an effective means for improving the physical strength of coke produced from Australian high volatile coals. Special attention has been given to studying the carbonising properties of Australian high inertinite coals. It was demonstrated that such coals produce coke of high physical strength and low reactivity and that if finely ground further improvement in coke strength can be obtained. The suitability of methods used by overseas buyers to predict quality of coke made from Australian coals has been investigated. All methods examined were found to be too inaccurate for satisfactory practical use.

10847 (NERDDP-EG—83-130) Regeneration of catalysts for use in continuous flow coal hydrogenation. Jackson, W.R.; Larkins, F.P.; Herton, P.A. (National Energy Research, Development and Demonstration Council, Canberra (Australia)). 1983. 338p. National Energy Research, Development and Demonstration Council, Canberra, Australia.

Conventional, oil industry hydrotreating catalysts such as sulphided nickel molybdate on alumina have been used to upgrade coal-derived liquids obtained from a 1 kg/hr bench-scale continuous coal hydrogenation unit. Their activity was not seriously affected by contamination with iron, and when the catalyst was deactivated by carbon deposition (coking) it could be easily regenerated by heating in air. All of the higher boiling, more polar products of coal hydrogenation can readily be converted into lower molecular weight, less polar products (oils) by heating with hydrogen in a hydrogen donor solvent, especially in the presence of a hydrotreating catalyst. These results may be very significant in the design of a coal liquefaction facility in that coal could be dissolved in a vehicle with the aid of an iron-based catalyst and the resulting product immediately stabilised, mainly as a desirable oil fraction by passing the material over a hydrotreating catalyst such as supported, sulphided, nickel molybdate.

10848 (ORNL/SGMP—84/2) Surface Gasification Materials Program. Semiannual progress report for the period ending September 30, 1984. Bradley, R.A. (Oak Ridge National Lab., TN (USA)). Dec 1984. Contract AC05-84OR21400. 102p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85004941.

Reported are: corrosion studies of plant materials surveillance tests (MPC/IITRI; slagging gasifier refractories: application/evaluation (ANL); protective coatings and claddings: application/evaluation (ANL); corrosion of structural ceramics in coal gasification environments (ANL); advanced pressure vessel materials technology (ORNL); electroslag component casting (ORNL); production and evaluation of electroslag castings (CIW); cost reduction of the electroslag casting manufacturing process (CMU); quantitative microstructural characterization of steel castings (UAB); and materials review and component failure analysis in support of coal gasification processes and plants (ANL).

10849 (SAND—84-1431) Coal liquefaction research. Quarterly report, April-June 1984. Granoff, B. (ed.). (Sandia National Labs., Albuquerque, NM (USA)). Aug 1984. Contract AC04-76DP00789. 31p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85005322.

This quarterly report for the period April through June 1984 summarizes activities in Sandia National Laboratories' continuing program of coal liquefaction research. The primary goals are to: explore novel catalytic concepts and materials for conversion of coal to liquid fuels; determine the effects of process variables on catalyst deactivation; determine the effects of coal structure and solvent properties on low temperature dissolution; study the kinetics and catalysis of hydrogen transfer reactions; develop an understanding of slurry gelling phenomena; and provide a technical assessment of coal liquefaction processes. During this period, work was performed on: analysis of catalyst samples from Wilsonville Run 246; catalyst presulfiding; catalyst activity testing using pyrene as a chemical probe; catalyst deactivation using a high-pressure model compound test reactor; dissolution chemistry of Wyodak coal; slurry gelling utilizing the helical screw rheometer; use of ESCA analysis to study activation of indirect coal liquefaction catalysts; hydrogenation of polynuclear aromatic components in coal-derived solvents; technology assessment of coal liquefaction processes; and exploratory catalysis research. 2 references, 4 figures, 5 tables.

0106 Properties

REFER ALSO TO CITATION(S) 01060010831, 10846, 10875, 10903, 10917, 11279

10850 (DOE/EV/10237—T1) Identification of polycyclic aromatic compounds containing two heteroatoms in coal liquids and shale oils. Incremental funding request and annual progress report, December 1, 1983-November 31, 1984. Lee, M.L.; Castle, R.N. (Brigham Young Univ., Provo, UT (USA). Dept. of Chemistry; University of South Florida, Tampa (USA). Dept. of Chemistry). 1984. Contract AC02-79EV10237. 74p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85004721.

Seventy-three polycyclic aromatic compounds containing sulfur, nitrogen, and oxygen heteroatoms have been synthesized to aid with the identification of predicted compounds in coal liquid fractions. The compounds for which analytical methodology has been developed during this period, and for which identifications have been made, are the hydroxylated two- and three-ring thiophenes, the aminodibenzothiophenes, and the hydroxylated nitrogen heterocycles. The Ames mutagenicities for the 1- and 4-aminodibenzothiophenes were found to be 10-100 times greater than for benzo[a]pyrene. A new fractionation scheme for isolating the sulfur heterocycles was developed. This method is based on ligand exchange chromatography and gives good recoveries of all sulfur heterocycles. Finally, a supercritical fluid fractionation system was constructed and applied to the fractionation of polycyclic aromatic compounds according to number of aromatic rings. 33 references, 21 figures, 5 tables.

10851 (DOE/FE/60339—T7, pp 5-8) Separation and fluorescence characterization of coal macerals . Miller, D.M.; Crelling, J.C. 26 Oct 1984. NTIS, PC A04/MF A01. File Number DE85000035.

In High-sulfur coal research at the SIU Coal Technology Center. Quarterly report, July 1-September 30, 1984.

The overall objective of this project is to establish a facility for the separation of coal macerals and to initiate a long-term program of characterizing the physical and chemical properties of maceral concentrates from a variety of coals of different age, rank, and origin. The specific objectives for this second year of the project are these: (1) to establish large scale separation of macerals; (2) to automate the quantificationof the macerals; (3) to optimize the maceral separation process in terms of maximum yields at various densitities, maximum size of particles, and minimum expenditure of time and commodities; (4) to improve methods of characterization of maceral concentrates by the comparison of properties of concentrates of whole coal samples with those of preconcentrated/lithotype samples; and (5) to improve other aspects of the separa-

tion process as time permits. At the end of this first quarter, we have set up a routine schedule of analytical (small-scale runs), begun large-scale runs, and begun fluorescence analysis of mounted specimens, all on one particular coal.

10852 (DOE/FE/60339—T7, pp 9-11) **Reduction of coal in solvated electron solutions.** Schneiderman, S.; Hombach, H.P.; Chen, J.W. 26 Oct 1984. NTIS, PC A04/MF A01. File Number DE85000035.

In High-sulfur coal research at the SIUC Coal Technology Center. Quarterly report, July 1-September 30, 1984.

Selective depolymerization will occur when finely ground coal is introduced into an inert atmosphere containing a solvated electron solution. Upon subsequent addition of a proton donor, reduction occurs at the depolymerized sites. The resulting decrosslinked product is characterized in order to gain insight into the molecular structure of coal. Also, the solid product is subjected to solvent extraction procedurs to determine its degree of depolymerization. The objectives of the research are to study the selective decrosslinkage of coal by using the solvated electron solution technique, to evaluate the characteristics of the reduced coal after each reduction, and to determine the extractability of the reduced coal with various solvents. Additionally, a sample coal was subjected to four consecutive experiments, each solid product serving as feed for the subsequent reaction. Elemental analyses indicate enchancement of the hydrogen to carbon ratio from 0.85 to 1.23 through the four experiments.

10853 (DOE/LC/10652—T1) **NMR studies of fossil fuels. Final technical report.** Maciel, G.E. (Colorado State Univ., Fort Collins (USA). Dept. of Chemistry). 1984. Contract AS20-81LC10652. 23p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005418.

This report has been based on a highly productive research effort involving collaboration between Colorado State University and the former Laramie Energy Technology Center. The CSU-LETC combination played a unique role in bringing NMR (nuclear magnetic resonance) to bear on certain types of fossil fuel problems that were previously not amenable to NMR study, i.e., those involving solid samples (coal, oil shale). The work drew heavily on fundamental solid-state NMR developments that had been previously reported from other laboratories, primarily in the MIT and Monsanto laboratories, and built upon these early developments to adapt and further develop new approaches for solid fossil fuel samples. For purposes of the present summary, work is separated into the following three categories: (1) Fossil Fuel Studies, (2) NMR Technique Development, and (3) NMR Instrumentation Development. Of course, there is a substantial amount of overlap between these categories; nevertheless, for convenience of organization each portion of our work has been placed into only one of these three frameworks for the present purposes. Numerous figures (spectra and plots) and tables summarize the voluminous data that have been generated.

10854 (KTM/E-D—42) **Terminology of the characteristics of fuel peat and coal.** (Kauppa- ja Teollisuusministerio, Helsinki (Finland)). 1983. 61p. (In Finnish, English, and German). Kauppa- ja Teollisuusministerio, Helsinki, Finland.

Terminology on peat and coal characteristics has been collected to a glossary. General conceptions connected with biomass and fossil fuels are also included. Terms are explained both with regard to practical significance and testing and analytics to create a source of information that gives the main characteristics of analyses and applications. (In Finnish, in English and in German)

10855 (NERDDP-EG—83-104) **Examination of the mineral components of coal and its resultant fly ash in relation to resistivity characteristics of the fly ash.** Pandich, T.; Sullivan, K.M. (National Energy Research, Development and Demonstration Council, Canberra (Australia)). 1981. 57p. National Energy Research, Development and Demonstration Council, Canberra, Australia.

Eleven widely ranging coals and their associated fly ash samples were obtained from several Australian power stations so that their chemical, physical and electrical properties could be determined. This was undertaken to help improve the understanding of the relationship between the basic properties of a coal and the electrostatic precipitability of its resultant fly ash. The coal minerals and fly ash were examined by X-ray fluorescence and X-ray diffraction techniques for elemental chemical and clay mineral analyses. The fly ash was also examined for electrical resistivity and surface chemical analysis using X-ray photoelectron spectroscopy. Scanning electron microscopy was used to examine both the coal and fly ash particles. This confirms that fly ash comprises a large number of particles of differing appearance or nature, chemical composition and shape, which led to the development of a nature, composition, shape classification system for identifying fly ash using a scanning electron microscope. Using the system, relationships were observed between the nature and composition of particles. A mathematical examination of the several chemical analyses and their relationship to the resistivity characteristics of the fly ash was undertaken. Although potential correlations between some coal characteristics and fly ash resistivity were observed, no firm relationship was established.

10856 (NERDDP-EG—83-133) **Comparative study of world blast furnace cokes: behaviour of ash components.** Gill, W.W.; Brown, N.A.; Coin, C.D.A.; Dubrawski, J.V.; Rogers, H.; Scaife, P.H. (National Energy Research, Development and Demonstration Council, Canberra (Australia)). 1983. 196p. National Energy Research, Development and Demonstration Council, Canberra, Australia.

A series of blast furnace coke samples were obtained from various ironmaking centres around the world. In most cases, samples of the corresponding coking coal blends and information on coke oven and blast furnace operations were also collected. The samples were fully characterised using both standardised tests and more recently developed or applied techniques. The results of this characterisation were used to compare and contrast these cokes with those produced in Australia. Special attention was given to ash. Some limited studies were done on the behaviour of coke ash at the high temperatures prevailing in the blast furnace.

10857 (NERDDP-EG—83-144) **Quantitative characterisation of mineral matter in a range of coals and coal generated materials.** Rigby, G.R.; Knott, A.C.; Doolan, K.J.; Dubrawski, J.V. (National Energy Research, Development and Demonstration Council, Canberra (Australia)). 1982. 102p. National Energy Research, Development and Demonstration Council, Canberra, Australia.

The development of techniques for the routine production and quantitative analyses of mineral matter present in a range of coal generated materials is outlined. Specific reference is made to the evaluation of low temperature ratio frequency ashing conditions required to separate the mineral matter from the original coal material. An optimal set of conditions has been specified for the instrument used in this work. The X-ray diffraction techniques used have been shown to be effective for bituminous coals. Some problems have been identified when analysing lower rank coals and fly ash due to the nature of the clays and other mineral components present. Comments on these limitations and ways in which the analyses could be improved are presented. A comprehensive set of chemical, petrographic, trace element and abrasivity measurements have also been carried out on the twenty three samples to allow the various analyses to be compared.

10858 (NERDDP-EG—83-153) **Coal characteristics and their role in hydrogenation.** Shibaoka, M.; Stephens, J.F.; Gilbert, T.D.; Kalman, J.R.; Leow, H.M. (National Energy Research, Development and Demonstration Council, Canberra (Australia)). 1982. 235p. National Energy Research, Development and Demonstration Council, Canberra, Australia.

The structures of Australian coals and macerals have been studied with the objective of optimizing their utilization, particularly for liquefaction. Techniques employed included, CP/MAS NMR, pyrolysis GC/MS, and scanning electron microscopy. Oxidative degradation studies of a suite of vitrinites and a hydrothermolysis study of Victorian brown coal were also performed. NMR demonstrated that Australian coals and macerals are similar in their

aromaticities and other general characteristics to those from elsewhere e.g. US. However, the oxidation studies suggested strongly that they differed in detail from the Carboniferous and Cretaceous coals of the US. Thus, the Australian coals generally lacked the oxygen heterocyclic structures previously found in the US coals. Victorian brown coal lost much of its oxygen when subjected to either pyrolysis GC/MS or hydrothermolysis, yielding mainly carbon dioxide and methoxy-substituted benzenes and phenols while the solid residues increased steadily in aromaticity with temperature treatment. An efficient back scattered electron detector was found to make scanning electron microscopy an ideal technique for observing mineral matter in coal.

10859 **(NERDDP-EG—83-163) Devolatilisation of brown coal.** Brockway, D.J.; Stacy, W.O. (National Energy Research, Development and Demonstration Council, Canberra (Australia)). 1982. 83p. National Energy Research, Development and Demonstration Council, Canberra, Australia.

The devolatilisation characteristics of two brown coal lithotypes were studied at rapid rates of heating. The coal was carried in the interstices of a stainless steel mesh strip which formed the heating element in the pyrolysis apparatus. The effect of heating rate variation was studied at final temperatures of 500 to 1250 degrees C. During heating of the mesh the change in its resistance was continuously monitored and the final temperature of the mesh was calculated from this change, together with the thermal coefficient of resistivity of the mesh. The residual char was determined gravimetrically and the evolved volatiles by difference. Gaseous products released by the coal were identified and determined by mass spectrometry. Tars evolved were determined by difference. The results showed that the yield of all products was dependent on the coal lithotype, heating rate and final temperature reached. The volatile product yields approached 70% of the original mass of dry coal at temperatures in excess of 1200 degrees C. At these temperature tars comprised almost half of the total volatile products. The tar yield was particularly lithotype dependent; the larger yields at each temperature resulted from the pale lithotype. At the more rapid heating rates and with final temperatures in excess of 1200 degrees C, typical yields of permanent gases were approximately, CO 20%, CO/SUB/2 9%, H/SUB/2O 8%, C/SUB/2H/SUB/4 3% and H/SUB/2 1%. In general the yield of pyrolysis tar vapours and gases was consistent with the known combustion characteristics of the two coal lithotypes. Product yields were also qualitatively consistent with the elemental and functional group analyses of the coals, and with differences in their overall chemical structure.

10860 **(NERDDP-EG—83-168) Applied coal and coke petrography.** Cudmore, J.F. (National Energy Research, Development and Demonstration Council, Canberra (Australia)). 1982. 204p. National Energy Research, Development and Demonstration Council, Canberra, Australia.

The petrographic properties of Australian coking coals have been studied and a better understanding of the carbonising behaviour of such coals and blends has been obtained. Reactivity of coke towards carbon dioxide has been shown to be dependent on rank of coals and blends. Prediction of strength of coke based on petrographic properties of coals has been studied and found to be too inaccurate for practical application. Continuing studies are needed in this area because of the importance attached to coke strength prediction by consumers and potential consumers of Australian export coking coals. Characterisation of coal hydrogenation residues using optical microscopy has been studied and encouraging results obtained.

10861 **(PNL-SA—11622) Integrated analytical approach to detailed chemical characterization of coal liquefaction process materials.** Later, D.W.; Chess, E.K.; Wright, C.W.; Wilson, B.W. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1984. Contract AC06-76RL01830. 19p. (CONF-8411138—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85004558.

From Direct coal liquefaction contractor's review conference; Pittsburgh, PA, USA (16 Nov 1984).

Due to the complexity and diversity of chemical species present in the products of coal liquefaction, methods that enable the class-specific separation and analytical determination of a wide concentration range of PAC constituents are of key importance in the detailed characterization of these complex materials. In this paper, an integrated analytical method for the quantitative and qualitative identification of the major chemical classes of coal conversion products has been reviewed. Specifically, techniques for the further elucidation of the neutral PAH, hydroaromatics, amino-PAH, and cyano-PAH have been presented. The end-goal in developing these methods is to provide a comprehensive data base of detailed information that can effectively assist the process engineer and biologist in establishing correlations between chemical composition and observed effects. 7 references, 11 figures, 1 table.

10862 **(PNL-SA—11623) Process-related effects on chemical composition of direct coal liquefaction materials.** Chess, E.K.; Wilson, B.W.; Wright, C.W.; Later, D.W. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1984. Contract AC06-76RL01830. 19p. (CONF-8411138—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85004545.

From Direct coal liquefaction contractor's review conference; Pittsburgh, PA, USA (16 Nov 1984).

Detailed chemical composition data on various process materials from a number of current coal liquefaction processes have been compiled as a result of investigating their biological activity. As a further extension of this work, these analytical data have been studied as a function of various process operation parameters. Inter- and intra-process comparisons have revealed insights into the fundamental characteristics of these various liquefaction processes. It has been shown that recycling the heavy-ends to extinction in the SRC II process leads not only to a product with virtually no mutagenic activity, but that this recycling actually increases the overall yield of higher quality product. The lower amine content in the EDS materials is a direct result of hydrogenation. The greater extent of alkylation found in EDS materials is characteristic of process specific mechanisms. A study of the detailed chemical differences between the process and product steams found in the coupled and noncoupled modes of TSL operation has confirmed that the recycle of a hydrogenated solvent to the liquefaction reactor is primarily responsible for upgrading the qualities of intermediate and end-products. 9 references, 6 figures, 9 tables.

0108 Waste Management

REFER ALSO TO CITATION(S) 01080010845, 10855, 10884, 10904, 10915

10863 **(CONF-841157—61) Potential resources from coal fly ash.** Watson, J.S. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 16p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005265.

From Symposium on the scientific basis for nuclear waste management; Boston, MA, USA (26 Nov 1984).

Recent studies at Oak Ridge National Laboratory (ORNL) and elsewhere have identified various chemical processes for recovering useful materials, such as alumina and iron oxides, from coal combustion fly ash. Based on certain assumptions, each of these processes can yield useful products at economical prices. Most processes leave a residual solid waste with a volume only slightly less than that of the original waste. This residue may not present a serious hazard, but its volume alone makes disposal difficult for utilities with limited land available for disposal sites. Characteristics of some of the residues are being studied to determine possible beneficial uses or applications of these by-products. 15 references, 4 figures, 2 tables.

10864 **(DOE/FE/60148—T9) Evaluation of the NOXSO combined NO/sub x//SO_2 flue gas treatment process: process chemistry, reaction kinetics and sorbent performance. Monthly progress report, March 1, 1983-March 31, 1983.** (NOXSO Corp., Paducah, KY (USA)). 26 Apr 1983. Contract AC22-82FE60148. 50p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85005646.

This report covers work accomplished under DOE Contract No. DE-AC01-82FE60148 during the period March 1 through March 31, 1983. The report presents a detailed discussion of chemical kinetic processes, a mathematical model describing these chemical kinetics and experimental data in support of the model. The

chemical kinetic constants obtained from experimental data are provided including rate constants as a function of temperature, activation energy, and Arrhenius' constant. A discussion of the factors which contribute to the sorbent's attrition properties are presented and data in support of the theory are presented. This report is the fifth in a series of nine monthly progress reports required under terms of this contract. 7 references, 12 figures, 5 tables.

10865 **(DOE/FE/60148—T10) [Evaluation of NOXSO combined NO/sub x/ and SO_2 flue gas cleanup]. Monthly progress report, April 1-30, 1983.** (NOXSO Corp., Paducah, KY (USA)). 26 May 1983. Contract AC22-82FE60148. 39p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85005647.

This progress report covers work accomplished under Department of Energy Contract during the period April 1 through April 30, 1983. It is the sixth in a series of eight monthly reports required under terms of the contract. The report presents the derivation of a general kinetics model that can be used to analyze data for reversible and irreversible reactions of either zero or first order. The model is used to calculate rate constants for the sorbent regeneration process. These results are then used to determine the reactant gas concentration from the fixed bed regenerator, showing a comparison with actual data. The model is also used to calculate rate constants for the reversible sorption of SO_2 and NO/sub x/. It is used to calculate the rate constants for the formation of sodium sulfide, the final product of the regeneration process. Additional attrition data and analysis are provided. The new data are for the Davison No. 1 material (3.5% sodium) adsorbed at 300°C and Davison No. 2 material (6.5% sodium) adsorbed at 300°C. A discussion of the adsorption chemistry is provided and a hypothesis proposed which explains some puzzling experimental observations. 3 references, 9 figures, 1 table.

10866 **(DOE/FE/60148—T11) [Evaluation of NOXSO combined NO/sub x//SO/sub x/ flue gas cleanup]. Monthly progress report, June 1-June 30, 1983.** (NOXSO Corp., Paducah, KY (USA)). 22 Jul 1983. Contract AC22-82FE60148. 70p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85005648.

This report covers work accomplished under Department of Energy Contract No. DE-AC22-82FE60148 during the period June 1 through June 30, 1983. It is the last in a series of eight monthly reports required under the terms of the contract. A part of June was spent organizing and beginning the final report. This work involves some experiments to fill data gaps. These will be completed in July and reported in the final report. In fact, the results of all experiments performed in June will be analyzed, integrated with previous results and presented in the final report. A proposal for extending the contract to evaluate process modifications which promise to improve the process was prepared and submitted to DOE in this reporting period. The Science Applications, Inc. economic evaluation of the NOXSO process is complete and their final report has been received. The SAI report and NOXSO preliminary comments and discussions are submitted as the progress report for June.

10867 **(DOE/MC/20035—1702) Evaluation of particulate collection devices developed for pressurized fluidized-bed combustors as applied to coal gasification processes.** Case, G.D.; Ushimaru, K.; Knoke, G.S.; Bernstein, S.; Bekowies, P.J. (Resource Technologies Group, Inc., Morgantown, WV (USA); Energy International, Inc., Bellevue, WA (USA); Flow Industries, Inc., Kent, WA (USA)). Oct 1984. Contract AC21-83MC20035. 241p. NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE85001988.

For several years the Department of Energy (DOE) has supported the development of devices for particulate cleanup of the effluent gas streams from pressurized, fluidized-bed combustion (PFBC). These devices are: acoustic agglomerator, under development at the Pennsylvania State University; ceramic baghouse filter, being developed by Acurex Corporation; ceramic cross-flow filter, under development at Westinghouse Electric Company; dry plate scrubber, from Air Pollution Technology, Inc.; ducon granular bed filter, being developed under contract to Westinghouse; electrostatically-enhanced granular bed filter, under development at General Electric Co.; electrostatic precipitator, at Research Cottrell and Denver Research Institute; electrocyclone, under development at General Electric; magnetically-stabilized bed filter, from Exxon Research and Development Company; and screenless granular bed filter, under development by Combustion Power Company. In each device, cleaning of the gas streams takes place at high-temperature and high-pressure (HTHP) conditions. The present stage of development for each device ranges from bench-scale to sub-pilot scale. Although none of these hot gas cleanup (HGCU) devices is ready for PFBC commercialization, sufficient data do exist to estimate the potential for applying these HGCU technologies to coal gasification gas stream cleanup also. 173 references, 46 figures, 47 tables.

10868 **(DOE/PC/60261—T4) Research and development for advanced combined NO/sub x//SO_2 removal systems. Technical progress report.** Kanter, I.E. (Westinghouse Electric Corp., Pittsburgh, PA (USA)). Jan 1985. Contract AC22-83PC60261. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005608.

Progress accomplished during the month of December, 1984, is briefly summarized. This project evaluates the feasibility of using a glow discharge chemical reactor to simultaneously remove at least 90% of the NO/sub x/ and SO_2 from coal-fired combustion flue gases from utility and industrial sources. The 24 month study proceeds in three phases starting with feasibility tests on a 75 CFM unit, through optimization and operation of a 600 CFM module. Characterization of the final product will be made. The major task of this period is to upgrade the test facility capability to allow testing at increased temperature and increased water content using a gas preheater and a secondary controller. This will demonstrate increased SO_2 removal capabilities.

10869 **(DOE/PC/60261—T5) Research and development for advanced combined NO/sub x//SO_2 removal systems. Technical progress report No. 15, October 29, 1984-November 30, 1984.** Kanter, I.E. (Westinghouse Electric Corp., Philadelphia, PA (USA)). Dec 1984. Contract AC22-83PC60261. 30p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85005655.

This project will evaluate the feasibility of using a glow discharge chemical reactor to simultaneously remove at least 90% of the NO/sub x/ and SO_2 from coal-fired combustion flue gases from utility and industrial sources. The 24 month study proceeds in three phases starting with feasibility tests on a 75 CFM unit, through optimization and operation of a 600 CFM module. Characterization of the final produce will be made. The 75 CFM unit has been operated over a range of NO and SO_2 concentrations, discharge configurations and flow geometries in order to determine which parameters are critical for the discharge reactor's performance and in order to optimize NO/sub x//SO_2 removal. One such attempt in finding out the effect of other parameters which may critically alter the discharge processes is that of increasing the average electron density in the discharge volume. For this negative pin glow discharge, the average electron density could be increased by decreasing the discharge gap. An additional factor also to be considered was the specific energy transferred into the gas stream. Limitations in specific energy have been imposed by the power dissipation in the ballast resistors. This could be mitigated with the same equipment if the parallel channel unit be transformed into a series channel unit.

10870 **(PB—85-109494/XAB) Summary of environmental impact assessment studies at the Vienna fly-ash disposal site. Final report.** Klose, P.N. (Environmental Resources Management, Inc., West Chester, PA (USA)). Jul 1984. 23p. NTIS, PC A02/MF A01.

From 1950 to 1972, Delmarva Power and Light Company (DPandL) operated a series of coal-fired generating units at their Vienna Power Station, located adjacent to the Nanticoke River in Wicomico County, Maryland. From 1966 to 1972, fly ash from these units was sluiced under the Nanticoke River to a diked disposal area of about 100 acres of wetland habitat adjacent to the river on the opposite bank. In conformance with standard industry practice at the time, this disposal site was neither lined nor covered. The fly-ash slurry covered about 80% of the disposal area when

use of the site was discontinued in 1972. Four interrelated studies were conducted between 1981 and 1983 to determine if significant environmental contamination had resulted from the disposal of fly ash in this wetlands environment. These environmental studies were conducted for the Maryland Department of Natural Resources-Power Plant Siting Program (MD-PPSP). The combined results of the four studies, which are integrated and summarized in this report, clearly show that no adverse environmental contamination has occurred from the disposed ash or its leachate constituents. From an environmental health perspective, the ash site does not appear to pose any threat of even minor health risk to users of fish and game living on or near the site.

10871 (UKY-BU—133, pp 329-335) **Simplified modeling of slurry impoundment effluent water quality.** Kalchthaler, R.F. Jr.; McLean, E.T.; Brown, E.H. Jr. Dec 1983. University of Kentucky, Lexington. (CONF-831162—).

From National symposium on surface mining, hydrology, sedimentology and reclamation; Lexington, KY, USA (28 Nov 1983).

A major West Virginia coal operator was faced with a problem of whether to divert an existing acid mine drainage source around a planned slurry impoundment or to divert the discharge into the impoundment for use as an additional source of preparation plant make-up water. The cost of designing and constructing the diversion was considered in light of the long-term liability for treatment if effluent water quality from the slurry impoundment could not meet NPDES requirements. A simplified mass balance water quality model was used to predict effluent water quality for the alternatives considered. In addition, the model included varying rates of withdrawal for preparation plant make-up water and underground mine dewatering inflows. Water quality and discharge of impoundment inflow sources, mine drainage sources and adjacent stream sources were obtained during the baseline monitoring for site permitting. Slurry decant and seepage water quality were estimated based on ASTM Method A, Water Shake Leaching Tests and Acid-Base Accounting Results. Inflow to the impoundment due to precipitation and loss due to evaporation were considered in the model. The deterministically calculated effluent water quality for the preliminary alternative recommended was routed downstream to simulate the effects on the receiving stream. Results of the model were discussed with the West Virginia Department of Natural Resources to identify potential permitting problems and obtain preliminary approval of the alternative selected through use of the simplified model.

10872 (UKY-BU—133, pp 349-353) **Modeling water quality during salty spoil suspension events.** Grove, J.H.; Evangelou, V.P. Dec 1983. University of Kentucky, Lexington. (CONF-831162—).

From National symposium on surface mining, hydrology, sedimentology and reclamation; Lexington, KY, USA (28 Nov 1983).

Water coming into contact with spoil clay colloids can undergo large changes in chemical composition (water quality). Salty spoil materials present particular problems due to the presence of chemical compounds of differential solubility; especially surface salts of calcium and magnesium. A model was developed to predict the solution phase chemistry of sulfate dominated colloid systems and tested on a pyritic spoil previously amended with various calcitic and magnesitic liming materials. The lime materials produced spoils with a wide range of sulfate salt chemistry. Unlimed and limed spoil samples were suspended in water, at water to spoil ratios ranging from 1:1 to 20:1 by weight. Solution phase calcium and magnesium levels were determined. The ability of the model to predict solution composition upon dilution (wetting) or concentration (drying) of the solution phase was evaluated. Predicting the magnesium concentration was found to be dependent on a proper estimate of the expansion of the exchange phase on clay colloid surfaces and/or changes in the selectivity of adsorption between calcium and magnesium with increasing salt strength. (8 refs.)

10873 (UKY-BU—133, pp 467-476) **Shrub cover and density on western rangelands in relation to reclamation standards for surface mined lands in Wyoming.** Boles, P.H. Dec 1983. University of Kentucky, Lexington. (CONF-831162—).

From National symposium on surface mining, hydrology, sedimentology and reclamation; Lexington, KY, USA (28 Nov 1983).

Grazing by domestic livestock together with a reduction in the number of natural wildlife has led to a dramatic increase in both the density and cover of woody vegetation since settlement, in the Western United States. Mining companies are currently required by state and federal laws to restore shrub density on mined lands to pre-mining levels when wildlife habitat is part of the post-mining land use. The optimum shrub densities and cover for various wildlife species are presently unknown and can only be speculated on, however it is doubtful that pre-mining density and cover values for shrubs are necessary in order to meet the needs of wildlife in the majority of cases. This paper is an attempt to bring together four elements: the historical record, vegetation baseline data, wildlife habitat studies and regulations in order to formulate a sound reclamation standard for post-mining shrub density and cover on reclaimed lands in Wyoming. A post-mining shrub density standard of one shrub per 9 square meters is proposed on land used jointly for livestock and wildlife grazing and browsing while a density of 1 shrub per square meter would be required in shrub patches established on 5-20% of the reclaimed surface in order to provide wildlife habitat. These standards would only be used on those lands with pre-mining shrub density higher than the proposed standards. (105 refs.)

10874 (UKY-BU—133, pp 497-501) **Vegetative response to topsoil versus alternative growth materials in a four-year old study in Kentucky.** Alderdice, L.; Graves, D.H. Dec 1983. University of Kentucky, Lexington. (CONF-831162—).

From National symposium on surface mining, hydrology, sedimentology and reclamation; Lexington, KY, USA (28 Nov 1983).

Twelve spoil amending treatments and a control were applied throughout three replications to evaluate vegetative response on disturbed sites in eastern Kentucky following a mining operation. Topsoil replacement was compared with different types and rates of organic mulching materials to determine whether or not differences were evident in cover percentage, biomass production, nutrient availability, or growth characteristics. The study was established in March, 1979. In 1981, a report was made on the results of vegetative response after three growing seasons. This included height response and cover percentages by grasses and legumes as well as total vegetative response. Comparisons were made at that time between treatments to evaluate any significant differences which existed. At this time, after four full growing seasons, additional data have been collected for further analyses of possible differences in vegetative response between plots receiving topsoil and those receiving any of the other alternative treatments. Biomass yield was determined on a per hectare basis, and soil and spoil samples were collected for analysis of nutrient availability, reactivity and water holding capacity, as well as any possible development of toxic material levels. (8 refs.)

10875 (UKY-BU—133, pp 549-554) **Evaluation of slope stability and foundation suitability for four southwestern Virginia mine spoils.** Bell, J.C.; Amos, D.F.; Parker, J.C. Dec 1983. University of Kentucky, Lexington. (CONF-831162—).

From National symposium on surface mining, hydrology, sedimentology and reclamation; Lexington, KY, USA (28 Nov 1983).

A study was conducted to evaluate the stability of spoil banks and the suitability of reclaimed benches for shallow foundations in SW Virginia. Mine spoils derived from four mixtures of overburden rocks from the Pennsylvanian Wise Formation were analyzed to determine particle size distribution, particle density, shear strength parameters, compaction characteristics and bulk density. (16 refs.)

10876 **(CE-Trans—7857) Re-heating flue gases from flue gas cleaning plants by means of heat exchangers.** Chughtai, M.Y. Translated from *Brennstoff-Waerme-Kraft ;* **33**: No. 5, 230-237(May 1981). 27p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85900122. DE85900122

Laboratory tests were carried out to solve problems in the re-heating of flue gases from flue gas cleaning plants. Tests at the clean gas end were concerned with the operating behaviour of tubular and plate-type heat exchangers. Extensive droplet separation, drying by means of flue gas recirculation and steam-blowing, alone

or in mutual combination, proved suitable for eliminating or removing caked matter. Research on raw gas in the laboratory and the power station was intended to determine corrosion-resistant materials for these heat exchangers. The Inconel 625 test pieces demonstrated the greatest resistance, compared with coated and non-coated materials. 13 figures, 1 table.

0109 Environmental Aspects

REFER ALSO TO CITATION(S) 01090010873, 10904

10877 **(KTM/E-D—41) Emissions of two milled peat fired power plants.** (Kauppa- ja Teollisuusministerio, Helsinki (Finland)). 1983. 74p. (In Finnish). Kauppa- ja Teollisuusministerio, Helsinki, Finland.

Emissions of a 100 MW pulverized peat/oil-fired boiler with ESP fly ash collector and a 7 MW/SUB/t peat/oil-fired FBC boiler with multi-cyclone fly ash collector were sampled and analyzed. Gaseous emissions (CO/SUB/2, SO/SUB/2, NO and CO) were sampled through a permeation distillation dryer. Organics were sampled with xylene-bubblers in ice-bath. Particulates were sampled before and after fly ash collectors. SO/SUB/2 emission from peat combustion was 150-250 mg/MJ. When burned with oil, SO/SUB/2 is dominated by the latter. NO emission was 100-150 mg/MJ from pulverized firing and 60-120 mg/MJ from FBC, CO-emission from pulverized firing was 20-25 mg/MJ with maxima - 100 mg/MJ and from FBC 50-200 mg/MJ with maxima 400 mg/MJ. Total organics emission was 6.6 mg/MJ from pulverized firing and 9.6 mg/MJ from FBC. The total (particulate + vapor) mutagenicity of the pulverized peat fired boiler emission was 8000-22000 rev/MJ in three 12 h to 72 h samples (TA98 + 59). Depending on peat quality and boiler operation the fly ash emission before collector can vary 500-10000 mg/MJ. The mean particulate emission from the pulverized peat boiler before the ESP was 2600 mg/MJ. It was log-normally distributed with median 1500 mg/MJ and Sg equals 1.8 (n equals 61). The average overall removal efficiency was 94%. After the ESP the mean emission was 160 mg/MJ. After the multicyclone the particulate emission of the FBC-boiler was on average 535 mg/MJ. Soot blowing emissions were 2.5-3.0 times higher than normal emission for both. It is concluded that the major environmental problem in peat combustion is particulate emissions. Organic emissions are also higher than in coal combustion due to low heat value and large variation of peat quality. Otherwise peat behaves rather like low sulfur coal. (In Finnish)

10878 **(NERDDP-EG—82-41) Trace elements in brown coal and its combustion products.** Bone, K.M.; Schaap, H.A. (National Energy Research, Development and Demonstration Council, Canberra (Australia)). 1981. 281p. National Energy Research, Development and Demonstration Council, Canberra, Australia.

Five separate mass studies were conducted at the brown coal-fired Yallourn E1 Power Station (120 MW). Mass balance data are presented for 29 elements, both major and trace, with additional data for some other trace elements. The partitioning of the elements in the combustion products and the emissions to air of major and trace elements, are discussed. Conclusions reached in a previous major study were confirmed by stack measurements.

10879 **(PB—85-109296/XAB) Economic effects of subsidence from underground coal mining on agricultural land in Illinois. Open file report, 1 September 1982-30 November 1984.** Guither, H.D. (Illinois Univ., Urbana (USA)). 30 Jan 1984. 61p. NTIS, PC A04/MF A01.

The objective of this study was to determine the economic impact of subsidence from underground coal mining on agricultural lands in Illinois. In a survey of Illinois agricultural extension advisers, the presence of subsidence from underground coal mining was reported in 31 counties. The most frequently reported problems were the presence of depressions or potholes, standing water in depressed areas, surface drainage disruption, broken tile lines, and reduced crop yields. The most frequently reported attempts to restore productivity from subsidence damage were to dig surface drainage ditches, haul in fill dirt, fill in depressions with tractor and blade or land leveler, and replace tile lines; success was varied. Positive identification of all subsidence occurrences and measurement of the area affected is very elusive.

10880 **(RISO-M—2420) Characterization of polycyclic organic matter (POM) from coal-fired power plants in the atmosphere and investigation of their transformation in the atmosphere.** Nielsen, T. (Risoe National Lab., Roskilde (Denmark)). Mar 1984. 13p. (In Danish). Risoe National Lab., Roskilde, Denmark.

This work describes investigation of the presence of polycyclic aromatic hydrocarbons (PAH), nitro-PAH and basic azaarenes in the atmosphere, evaluation of the importance of different sources (especially coal-fired power plants) for the presence of PAH in the atmosphere and clarification of the atmospheric chemistry of PAH, especially their reaction with nitrogen dioxide/dinitrogentetroxide and nitric acid. (In Danish)

10881 (UKY-BU—133, pp 289-295) **Hydrologic characterization of the saturated zone associated with contour surface mining spoil in the New River Basin of Tennessee.** Dickens, P.S.; Tschantz, B.A.; Minear, R.A. Dec 1983. University of Kentucky, Lexington. (CONF-831162—).

From National symposium on surface mining, hydrology, sedimentology and reclamation; Lexington, KY, USA (28 Nov 1983).

The spoil resulting from steep-slope contour surface mining of coal in the mountainous New River Basin of Tennessee was examined to determine its extent of saturation. Two well sites were established on this material and periodically monitored for groundwater elevations. The areal extent of the spoil saturated zone was determined with a series of temporary, hand-driven observation wells. Accompanying the spoil investigation was streamflow monitoring in several mining disturbed watersheds. Hydrologic data developed from this research are presented. Temporal and spatial variations in the data are discussed, and storage volumes in the mining spoil are quantified. (15 refs.)

10882 (UKY-BU—133, pp 355-363) **Effects of coal mining on ground-water quality in West Virginia.** O'Steen, W.N.; Rauch, H.W. Dec 1983. University of Kentucky, Lexington. (CONF-831162—).

From National symposium on surface mining, hydrology, sedimentology and reclamation; Lexington, KY, USA (28 Nov 1983).

Acid mine drainage is a major ground water pollution source in the north-central Appalachian Mountains, including much of West Virginia. A study was made of coal mine impacts on ground water quality, in a 220-square-mile area of northern Preston County (northern West Virginia). 139 wells and springs located near potential mine-drainage pollution sources were sampled and tested for the following: temperature, specific conductance, and pH in the field, and both filtered-acidified and untreated samples were analysed in the laboratory for: sulfate, dissolved iron, dissolved manganese, calcium, magnesium, bicarbonate, nitrate, sodium, and chloride concentrations. Physical data were also collected for all sampled wells and spring. (10 refs.)

10883 (UKY-BU—133, pp 517-524) **Chemical quality of the saturated zone associated with contour surface mining spoil and its effect on stream water quality.** Dickens, P.S.; Rose, R.R.; Minear, R.A. Dec 1983. University of Kentucky, Lexington. (CONF-831162—).

From National symposium on surface mining, hydrology, sedimentology and reclamation; Lexington, KY, USA (28 Nov 1983).

The spoil resulting from steep-slope contour surface mining of coal in the mountainous New River Basin of Tennessee was examined to determine its extent of saturation and the water quality associated with this saturated zone. Two well sites were established on the material and periodically monitored for groundwater elevations and water quality. The quality of the saturated zone throughout the mining spoil was examined with a series of temporary, hand-driven observation wells. Accompanying the spoil investigation was periodic monitoring of mining disturbed stream flow and stream water quality. Mineral constituent concentrations in the spoil saturated zone were found to be significantly elevated above those found in the natural, undisturbed groundwater system of the watersheds studied. Overall pH is slightly acidic with a median value of 6.3. Calcium and magnesium are the major cations; bicar-

bonate the major anion. Heavy metal concentrations are small, generally less than levels described by drinking water standards. The contour surface mining spoil was shown to be a large reservoir of mobilized mineral constituent mass. The effect of this mass on stream water quality in a mining watershed was quantified and was found to be substantial. (21 refs.)

10884 (UKY-BU—133, pp 531-536) **Evaluation of existing data on discharges from active coal mines in Illinois.** Lee, M.T.; Terstriep, M.L. Dec 1983. University of Kentucky, Lexington. (CONF-831162—).

From National symposium on surface mining, hydrology, sedimentology and reclamation; Lexington, KY, USA (28 Nov 1983).

Nearly 90% of the active coal mines in Illinois are located in only 4 of the 19 major river basins of the state. An evaluation was conducted based on four data sets which include: 1) the National Pollution Discharge Elimination (NPDES) permit program; 2) receiving stream data collected by Illinois EPA and the U.S. Geological Survey; 3) receiving stream data collected by the Illinois State Water Survey; and 4) a data set collected in mine areas and receiving streams in Southern Illinois at selected stations. Data analyses were performed on the four major basins. The mine area and receiving stream water quantity and quality data were tabulated and the maximum and minimum concentrations of nine chemical constituents were compared. Detailed observations on the spatial distribution of active mine areas revealed that poor water quality in receiving streams was not directly related to the active coal mine areas. It appears that extensive abandoned mine areas are the source of water pollutants. In addition to comparing the available data, six active mines were visited to obtain a first-hand understanding of coal mine discharge and water sampling procedures. A set of recommendations for improving data collection and additional research were also outlined. (14 refs.)

10885 (UKY-BU—133, pp 537-541) **Erosion characteristics of surface-mined soils.** Mostaghimi, S.; Mitchell, J.K. Dec 1983. University of Kentucky, Lexington. (CONF-831162—).

From National symposium on surface mining, hydrology, sedimentology and reclamation; Lexington, KY, USA (28 Nov 1983).

Erosion characteristics of four-surface-mined topsoils were studied, using a laboratory rainfall simulator. Rainfall intensities of 64 mm/hr were applied for two hours to soil samples of 90 cm x 90 cm x 15 cm deep on different slopes. Runoff and sediment from each soil sample was collected throughout the entire rainfall event at 10-minute intervals. Analyses of the data indicated that runoff rates increased rapidly at the start of the run and continued to increase, but at a slower rate, until they approached the rate of rainfall application near the end of the storm. Increased slope resulted in increased erosion without effecting aggregate- or particle-size distribution. The eroded sediment was primarily composed of silt-sized primary particles and aggregates. The soil erodibility factor, K, varied with slope of the sample soil bin. (14 refs.)

10886 **Effects of chronic exposure to coal-derived oil on freshwater ecosystems. I. Microcosms.** Franco, P.J.; Giddings, J.M.; Herbes, S.E.; Hook, L.A.; Newbold, J.D.; Roy, W.K.; Southworth, G.R.; Stewart, A.J. (Oak Ridge National Lab., TN). *Environmental Toxicology and Chemistry;* **3**: 447-463(1984). Contract W-7405-ENG-26.

Sixteen 67-liter freshwater microcosms were treated for 8 weeks with an unrefined coal-oil in amounts ranging from 0.03 to 7 ml per week. Phenols make up 95% of the water-soluble compounds in this oil, and dissolved phenol concentrations averaged < 0.01 mg L^{-1} in the lowest dose and 10 mg L^{-1} in the highest. The microcosms were severely damaged at the highest treatment level; macrophytes, zooplankton and insects were eliminated, and the ecosystems became anaerobic. Microcosms did not recover to pretreatment conditions within 5 months. At lower dosages there were temporary effects on ecosystem metabolism, water chemistry and community structure. The most sensitive indices, community respiration, production/respiration ratio, pH and cladoceran zooplankton numbers, were affected at phenol concentrations below the lowest observable effect concentration of a chronic Daphnia magna bioassay.

10887 **Effects of chronic exposure to coal-derived oil on freshwater ecosystems. II. Experimental ponds.** Giddings, J.M.; Franco, P.J.; Cushman, R.M.; Hook, L.A.; Southworth, G.R.; Stewart, A.J. (Oak Ridge National Lab., TN). *Environmental Toxicology and Chemistry;* **3**: 465-488(1984). Contract W-7405-ENG-26.

Ten 15-m^3 outdoor ponds were treated daily for 8 weeks with a synthetic coal-derived crude oil; ecological effects were monitored for an additional 52 weeks. The experimental design included two replicate ponds at each of five oil input rates (from 1 to 16 ml/m^3/d) plus two untreated controls. A gradient of responses was observed across the gradient of treatment levels. Cladoceran zooplankton populations and ecosystem metabolism (production/respiration) were affected at the lowest input rate, but the effects disappeared before the end of the oiling period and this exposure level (approximately 3% of the 48-h LC_{50} for Daphnia magna) was considered safe for this ecosystem. At the next higher treatment level, effects on zooplankton and ecosystem metabolism were greater and persisted until the oiling ended; reproduction of mosquitofish (Gambusia affinis) was also impaired. Major changes occurred throughout the ecosystem at higher treatment levels. The two highest treatment levels completely disrupted the pond community. The ponds recovered from the next-to-highest treatment but the effects of the highest treatment persisted for more than a year. Indirect effects occurred at all treatment levels and included changes in water quality, replacement of sensitive taxa by more tolerant competitors and changes in abundance of some species because of increases or decreases in their predators. The results of this experiment were qualitatively and quantitatively similar to those of a parallel experiment in pond-derived microcosms, and thus substantiated the ability of the microcosms to simulate larger, more natural ecosystems.

0110 Reserves And Exploration

REFER ALSO TO CITATION(S) 01100010899, 10900

10888 **(KTM/E-B—28) Long term use of Finnish peat resources.** (Kauppa- ja Teollisuusministerio, Helsinki (Finland)). 1983. 99p. (In Finnish). Kauppa- ja Teollisuusministerio, Helsinki, Finland.

The aim with the work has been to estimate the amount of peat resources in Finland that are suitable for peat production and to evaluate the potential consumption and sufficiency of the peat resources in the long term. The total area of peat bogs suitable for production has been estimated at about 500,000 ha. This is about 10% of the total surface of bog greater than 20 ha and less than 80% of the surface of protected bogs. The energy content in the bogs suitable for production has been estimated to about 4,700 TWh (420 Mtoe). Over a half of this amount is located in the northeast parts of the country, in Oulu and Lappi. The fuel peat consumption in 1981 was about 7 Mm/SUP/3. The evaluation of the potential consumption was concentrated to the area north of the line Lappeenranta - Kouvola - Haemeenlinna - Pori. Neither the availability of peat nor the financing of the investments were considered in the evaluation. Additionally no change in the competitiveness between peat and alternative fuels was accounted for. With these assumptions the total peat consumption would appear to grow very rapidly during this decade, on an average 2 Mm/SUP/3 per year and reach a value of 30 Mm/SUP/3/a in 1990. It has been assumed that the consumption would be relatively constant after the year 2000. With a maximum transportation distance of about 180 km the peat resources are estimated to be sufficient for a period longer than 50 years in the southern part of the country while about 100 years in other parts. The peat resources in Lappi are estimated to last over 200 years. (In Finnish)

10889 **(NERDDP-EG—83-103) Cryogenic gravity gradiometer for geophysical exploration.** Buckingham, M.J.; Edwards, C.; Vann Kann, F.J.; Penny, R.D.; Keye, M.; Searls, J. (National Energy Research, Development and Demonstration Council, Canberra (Australia)). 1983. 40p. National Energy Research, Development and Demonstration Council, Canberra, Australia.

Advanced high technology and cryogenic methods are bringing into being a completely new type of astronomy. Funda-

mental research into the detection of gravitational radiation is being carried out at the University of Western Australia, and the production of the gravity gradiometer is discussed. Cryogenic technology, incorporating the unique properties of superconductors, permits a great increase in sensitivity compared with conventional gravimetry instrumentation and leads to the further reasonable hope of efficient airborne gravity survey methods.

10890 **(NERDDP-EG—83-112) In seam exploration in coal mines using vibration measurement.** Scaife, P.H.; Leung, L.; Downey, M.; Kilgallon, A. (National Energy Research, Development and Demonstration Council, Canberra (Australia)). 1982. 104p. National Energy Research, Development and Demonstration Council, Canberra, Australia.

This report describes the developments of in seam seismic (ISS) exploration techniques for locating discontinuities in underground coal mines. Face to face, face to borehole ISS surveys have been staged at various collieries in NSW and Queensland. Equipment and field procedures used in these surveys are presented. With the aid of various computer processing programs currently under development, suitable means of signal conditioning and imaging for face to face surveys have been derived. Numerical modelling work, aimed at providing a better understanding of the physics involved in ISS, is also described. Four modelling studies are being conducted, each utilising different computer-aided numerical analysis techniques. Instrumentation developments, including a custom made data acquisition system, surface to underground communication systems, detectors and repetitive noise sources, are also outlined.

10891 **(NERDDP-EG—83-119) Computer modelling of coal basins.** Phillip, G.M.; Watson, D.F. (National Energy Research, Development and Demonstration Council, Canberra (Australia)). 1983. 56p. National Energy Research, Development and Demonstration Council, Canberra, Australia.

The objectives of this project were to develop and to evaluate computer modelling of coal basins directed to aid rapid coal basin assessment and sedimentary resource estimation in probabilistic terms. The project explores the application of computer deposit modelling to arrive at probabilistic estimates of coal resources. The work exposed problems in established techniques dealing with a large body of exploration data of a deterministic character. Computer based statistical methods were investigated in depth and a new method is presented for the precise computing of scattered data points, which allows assessment of the error associated with estimation for a given pattern and density of sampling. A by-product of the project was an investigation of the most efficient drilling patterns for establishing reserves in a coal prospect.

10892 **(NERDDP-EG—83-120) Facies modelling and palaeoenvironmental reconstruction of coal measures sedimentation within several Queensland coal basins.** Flood, P.G. (National Energy Research, Development and Demonstration Council, Canberra (Australia)). 1982. 100p. National Energy Research, Development and Demonstration Council, Canberra, Australia.

The objectives of the research programme were to develop conceptual models of the environments of deposition of coal measure sediments within several sedimentary basins of different geological age within the state of Queensland. The models are based upon detailed analysis of the available sedimentological data, including: the use of recognition criteria to distinguish depositional processes, the study of vertical profiles, either drill core or highwalls, to illustrate the changing patterns of the depositional environments throughout time, and to develop a detailed facies analysis of the conditions of coal measure sedimentation. Results of the studies enable palaeoenvironmental reconstructions to be made for individual sedimentary basins.

0120 Mining

REFER ALSO TO CITATION(S) 01200010871, 10872, 10873, 10874, 10875, 10881, 10882, 10883, 10884, 10885, 10890, 10932, 10949

10893 **(ACIRL-PR—84-11) Gas drainage by horizontal longhole drilling: field trials at Tahmoor Colliery.** Allan, J. (Australian Coal Industry Research Labs. Ltd., North Ryde). 1984. 52p. Australian Coal Industry Research Labs. Ltd., North Ryde.

The primary objective of this work program was to develop techniques for pre-drainage of seam gas at least 600 metres in advance of workings on a routine basis. Trials of gas drainage using in-seam longholes, drilled with an Acker 'Big John' degasification rig were carried out at Tahmoor Colliery. Seven holes were drilled in seam, representing a total length of approximately 2,635 meters, the longest hole drilled being 732 meters. The holes were located in 102 and 100 Panels to alleviate both the emission of gases in the face area and to reduce the propensity of the coal to outburst. Significant flows of CO/SUB/2 and CH/SUB/4 were monitored from the holes with some flows in excess of 2,000 l/min. All holes were only free flowing as Tahmoor Colliery does not have a gas evacuation system.

10894 **(DOE/PC/52274—T5) Mining research and development program. Second quarterly report, June 25, 1982-September 25, 1982.** Dingerson, M.R. (Southern Illinois Univ., Carbondale (USA). Coal Extraction and Utilization Research Center). 1982. Contract FG22-82PC52274. 37p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85005438.

Progress in six technical project activities at Southern Illinois University are reported: Hydraulic Fragmentation; Analysis of Economics and Productivity in Strip Mining; Integration of Man and Machine into Efficient Mining; Computer Models for Simulation in Coal Mining; Geotechnical Studies Related to Advanced Mining; and Dragline Simulator Training Systems.

10895 **(NERDDP-EG—83-109) Longwall coal mining operations computer simulation.** Roxborough, F.F. (National Energy Research, Development and Demonstration Council, Canberra (Australia)). 1982. 334p. National Energy Research, Development and Demonstration Council, Canberra, Australia.

This research thesis provides the mining analyst with an effective means of experimentation with any mining layout. SIMCAL is a generalised simulation program suitable for investigating different models. The models are constructed by arranging elements called activities, equipment items, memories and branches. The branches allow any number of activities to occur simultaneously and therefore allow the construction of a model even for the most complex real world system. Reports of the analysis are produced in tabular form and can be generated on a shift to shift basis together with graphical displays. After describing the ideas and procedures inherent in SIMCAL, a bord and pillar model was constructed and tested. The same problem was also tested in simulation program COALSIM. The two programs were compared and the existing differences explained. An initial model for a longwall method of mining is discussed and several interesting variations of modelling possibilities listed. The complete listing of the main program SIMCAL and the plotting program SIMPLOT are supplied.

10896 **(NERDDP-EG—83-113) Mine roadway stabilisation.** Carruthers, J.; Schaller, S.; Mikula, P. (National Energy Research, Development and Demonstration Council, Canberra (Australia)). 1982. 178p. National Energy Research, Development and Demonstration Council, Canberra, Australia.

This report deals with the monitoring work and mathematical modelling work carried out to evaluate the performance of different chain pillar widths in protecting underground roadways during longwall extraction. The main findings are that the previous chain pillar width of 17 m is insufficient to maintain the stability of the stores road/tailgate, and that an increase in width to 33 m is required to give stability in the geotechnical environment obtaining

at South Bulli Mine 'B'. Mathematical modelling using both THREED and Finite Element techniques were used and substantially support the observational findings.

10897 **(NERDDP-EG—83-127) Mine ventilation subsequent to explosions and fires.** Upfold, R.W. (National Energy Research, Development and Demonstration Council, Canberra (Australia)). 1982. 150p. National Energy Research, Development and Demonstration Council, Canberra, Australia.

Underground mine ventilation is now commonly simulated on a digital computer. Such a program, incorporating natural ventilation has been modified to account for methane emission and elevated local temperatures. At Wollongong University, the program was further developed and extensive interactive graphics incorporated such that any section of the three dimensional mine could be viewed, and superimposed upon that view are areas where a nominated parameter has exceeded a particular value: generally at a nominated time after a particular event, usually a fire/explosion of one type or another. A further program was developed such that a particular location could be examined up to 20 times after, say, a fuel-rich fire at some other place in the mine. The output from this program includes a plot of methane %, smoke %, temperature, pressure and air flow versus time, a most useful graphic to observe the limits of safe attendance in a particular airway.

10898 **(NERDDP-EG—83-136) Coal overburden project.** (National Energy Research, Development and Demonstration Council, Canberra (Australia)). 1983. 58p. National Energy Research, Development and Demonstration Council, Canberra, Australia.

In-situ rock mass structure has a major influence on the effectiveness of blasting. A programme aimed at measuring structure quantitatively using acoustic techniques and relating this to the response of the rock mass during blasting has been undertaken. The programme was based on the development of instrumentation and interpretative techniques, the use of acoustic instrumentation in determination of rock mechanics parameters and the evaluation of blast effectiveness. The correlation of acoustic properties with structural features involved geological and laboratory testing of samples as well as in-situ rock mass assessment. Blast design modification incorporating structural information gained during the research project has improved fragmentation and increased dragline productivity by 15% at one site. Studies conducted at another site have provided information vital to the selection of the most appropriate mining equipment.

10899 **(NERDDP-EG—83-148) Geomechanical evaluation of alternative underground mining methods.** Enever, J.R. (National Energy Research, Development and Demonstration Council, Canberra (Australia)). 1983. 72p. National Energy Research, Development and Demonstration Council, Canberra, Australia.

A summary is given of critical geotechnical considerations relevant to the introduction of innovative underground mining technology to Australian coal basins. The basis of a means defining priority areas for further research is outlined, based on an understanding of geotechnical factors implicit in specific mining techniques and the geomechanics of selected regions. There is a description of on going research in a number of aspects arising from the definition of priority areas. The aspects covered are: prediction of roof caveability, study of load distribution to supports etc., stability of permanent coal pillars, reconsolidation of caved roof material in multi slice thick seam extraction, and hydraulic cutability of Australian coals. In each instance the rationale behind the research approach, significant results obtained to date and their implications in terms of the project aims are discussed.

10900 **(NERDDP-EG—83-150) Stability of spoil piles and highwalls in deep surface mines.** Mallett, C.W.; Dunbavan, M.; Seedsman, R.W.; Ross, D.J. (National Energy Research, Development and Demonstration Council, Canberra (Australia)). 1983. 201p. National Energy Research, Development and Demonstration Council, Canberra, Australia.

Slope stability within surface coal mines of the Bowen Basin has been studied in a research program integrating field and laboratory studies. Failure mechanisms operating are the translational type, with a two wedge configuration typical of spoil piles. Basal failure planes are developed from in-situ deterioration of material strength, or along existing weak discontinuities, in the geological section. Physical modelling of spoil pile failures by base friction and centrifuge confirm the two wedge failure model interpreted from field results. Mathematical modelling of this failure mode using the virtual work principle is shown to give a more reliable prediction of behaviour than limiting equilibrium methods.

10901 **(NERDDP-EG—83-154) Prediction and monitoring of roof conditions.** Creasey, J. (National Energy Research, Development and Demonstration Council, Canberra (Australia)). 1983. 79p. National Energy Research, Development and Demonstration Council, Canberra, Australia.

Detailed geological and geotechnical investigations have defined the particular relationships of stress, lithology and geological structure in a number of collieries in NSW and Queensland coalfields. The quantitative and statistical assessment of the geological variables has led to a better understanding of the failure criteria and development of ideas on the failure mechanism at some of these mines. These results have provided fundamental information for studies on the design and improvement of roof support techniques that are necessary for overcoming present and future roof instability problems. Variations in fracture patterns in the coal seam and enclosing sediments forming domains have been found throughout colliery workings. Systematic fracture mapping techniques for delineatinag changes in fracture patterns have been developed and tested. Changes in both the trends and distribution of fractures around major geological structures have been demonstrated, and can be used as short term prediction of approaching structures ahead of a working face.

10902 (UKY-BU—133, pp 283-287) **New publications for road systems at coal mines.** Wiles, R.A. Dec 1983. University of Kentucky, Lexington. (CONF-831162—).

From National symposium on surface mining, hydrology, sedimentology and reclamation; Lexington, KY, USA (28 Nov 1983).

The US Office of Surface Mining recently published a document, 'Coal Mine Road Technology - An Assessment of References and Annotated Bibliography', (Coal Mine Road Technology Bibliography) which contains an extensive listing of technical references that provide guidance for developing road systems at coal mines. This paper discusses the content and the rationale for publishing such an extensive reference document. In addition, a news publication from the US Fish and Wildlife Service, 'Handbook for Protection of Fish and Wildlife from Construction of Farm and Forest Roads', is reviewed for its application to road systems at coal mines. A brief discussion of the Federal rules for coal mine roads is also included. (3 refs.)

10903 (UKY-BU—133, pp 309-314) **Prediction of quality and quantity of open pit mine flow from saturated abandoned underground mine workings.** Traylor, R.Y. Dec 1983. University of Kentucky, Lexington. (CONF-831162—).

From National symposium on surface mining, hydrology, sedimentology and reclamation; Lexington, KY, USA (28 Nov 1983).

Underground mining in the Walsenburg Coal Field of Colorado began in 1881 and continued until 1972. These mines were generally small, but encountered large inflow as mining proceeded under ephemeral drainages. Since underground mining has terminated and dewatering pumps have been turned off, the abandoned workings have become completely saturated with surface and ground water. Long residence time for water in these workings has allowed oversaturation of several minerals. Oxidation of pyrite located in coal seams increases water acidity which in turn reacts with carbonate minerals present in the sandstones and shales, resulting in carbonate dissolution. Results of chemical analyses indicate high concentrations of sulfate, manganese, iron, fluoride, boron, and silica. Values for iron range as high as 730 mg/l. Electrical conductivity values for water in the workings are typically greater than 4,500 MUmho/cm but range up to 17,000 MUmho/cm. The open pit will intersect 20 saturated abandoned mines over 6.25 miles. Hydrogeologic analyses indicate that a minimum of 2,000 acre-feet of highly mineralized water must be discharged over a period of six years. Disposal of water from these workings can be achieved

through a combination of direct discharge to ephemeral stream channels, evaporation in retention ponds, and application to roads for suppression of dust. (3 refs.)

10904 (UKY-BU—133, pp 543-548) **Conceptual model of ground-water flow in the Eastern Kentucky coal field.** Kipp, J.A.; Lawrence, F.W.; Dinger, J.S. Dec 1983. University of Kentucky, Lexington. (CONF-831162—).

From National symposium on surface mining, hydrology, sedimentology and reclamation; Lexington, KY, USA (28 Nov 1983).

The Kentucky Geological Survey has been conducting a study in the Eastern Kentucky Coal Field since 1980 to determine the various hydrogeologic conditions that exist in the region. One of the most important segments of the project is the documentation of ground-water conditions in a drainage basin before, during, and after mining. The goals of this investigation are to develop a conceptual model of ground-water flow for a small basin and to determine the effect of mining and reclamation on local flow conditions and ground-water quality. This part of the project was conducted in Knott County, Kentucky, and involved the documentation of conditions in a small watershed reflecting various stages of mining. Monthly water-level measurements were taken in thirteen observation wells and continuous recorders were installed on six of the wells. Preliminary aquifer testing and water quality analyses have also been completed. (7 refs.)

10905 **(HSE-Trans—10002) Detection of fire hazards in belt conveyors in coal mines.** Grumbrecht, K. (Health and Safety Executive, London (UK); SEE CODE- 9699959 Versuchsgrubengesellschaft m.b.H., Dortmund (Germany, F.R.)). Feb 1981. Translation source information not available . (CONF-8110246—4). 12p. NTIS (US Sales Only), PC A02. File Number DE85900531.

From 19. international conference of research institutes in safety in mines; Katowice, Poland (5 Oct 1981).

The risk of fire propagation is particularly high in equipment used in the form of long lengths. Conveyor belts can be made so that they are, to some extent, fire-resistant; they cannot, however, be made non-flammable. If they are used for conveying a combustible material such as coal, early detection of fires in belt conveyor roads is particularly important. Not only smouldering fires in coal but even dangerous heatings of parts of the belt conveyor or of coal should be automatically detected and reported. At the Tremonia Experimental Mine tests were carried out on stationary, automatic and also portable instruments for the detection of heating in conveyor belts and of smouldering fires in coal. Both types of instrument are of interest, because it is desirable, after a signal from a stationary, automatic instrument, to be able to use a portable instrument to find a danger spot that has possibly not been detectable by sensory perception. The following items in automatic instruments were tested: wires, the insulation of which loses some of its electric resistance on heating and which consequently allows an electric current to flow; metal oxide semiconductors, in which the electric resistance is altered as a result of the effect of decomposition products; ionisation fire detectors. The infra-red radiation from heat sources was measured with portable instruments. The various fire detection appliances are compared with each other and assessed.

0130 Transport And Handling

REFER ALSO TO CITATION(S) 01300010831, 10833, 10834, 10842, 10871, 10894, 10902, 10932

10906 (DOE/FE/60339—T7, pp 12-17) **Ultrasonic vs mechanical comminution of coal II.** Robinson, P.; Shoemaker, C. 26 Oct 1984. NTIS, PC A04/MF A01. File Number DE85000035.

In High-sulfur coal research at the SIUC Coal Technology Center. Quarterly report, July 1-September 30, 1984.

This investigation is designed to characterize coal produced by ultrasonic grinding equipment and to compare the results with equivalent data derived from conventional grinding methods. The techniques being utilized are scanning electron microscope-based automated image analysis (SEM/AIA) and high-resolution scanning electron microscopy. The results of data collected on samples with a top size of 200 mesh indicated that ultrasonic grinding produced a slightly larger mean size without the coarse outliers present in the ballmill and hammermill samples.

10907 (DOE/FE/60339—T7, pp 27-31) **Hydrocylcone system for recovery of low-sulfur coal fines from gob.** Davis, P.K. 26 Oct 1984. NTIS, PC A04/MF A01. File Number DE85000035.

In High-sulfur coal research at the SIUC Coal Technology Center. Quarterly report, July 1-September 30, 1984.

The objectives of this research project are as follows: (1) to study the pumping characteristics of slurries of coal and water at various concentrations of gob so that a determination can be made as to the feasibility and power requirements for transporting the material by pipeline; and (2) by use of all previous data taken, to design and construct a laboratory-size pilot system to demonstrate continuous processing of waste materials for the efficient recovery of coal fines. Five tons of gob have been donated from an old mine site in the Illinois Basin. After washing, this gob has been analyzed as to coal content and particle size. A device for rapid float-sink analysis of the hydrocyclone underflow and overflow product has been designed and constructed. Another phase of this study involves the pumping characteristics of gob-water mixtures. The goal is to optimize the operating conditions with respect to cost effectiveness for the transport of gob-water slurries in pipelines. The gob will be crushed and washed at the gob pile to remove the clay; the remaining solid materials will be slurried and pumped to a processing plant. A pipeline system has been designed and is currently under construction for a laboratory study of the head losses both in straight sections and in bends.

10908 (DOE/FE/60339—T7, pp 32-34) **Size classification of Illinois basin coals for desulfurization by froth flotation.** Sinha, A.K. 26 Oct 1984. NTIS, PC A04/MF A01. File Number DE85000035.

In High-sulfur coal research at the SIUC Coal Technology Center. Quarterly report, July 1-September 30, 1984.

Ten coal mines operating in different areas of Illinois have been selected and authorities have been contacted for permission to draw required samples. Coal samples from three of the selected coal mines have already been drawn for laboratory testing. Further sampling is planned, following the testing of previously collected samples. A jaw crusher and a float and sink machine have been acquired and are now being installed at the Coal technology Laboratory. Laboratory testing will start in the near future.

10909 (DOE/FE/60339—T7, pp 35-42) **Desulfurization of coal slurries by electrolysis.** Lalvani, S.B. 26 Oct 1984. NTIS, PC A04/MF A01. File Number DE85000035.

In High-sulfur coal research at the SIUC Coal Technology Center. Quarterly report, July 1-September 30, 1984.

Amorphous sulfur and mineral pyrite used as model compounds of inorganic sulfur present in coal were oxidized electrochemically. Electroxidation of aqueous slurries of sulfur resulted in evolution of hydrogen gas at the cathode while sulfuric acid was generated in the anode compartment. Dissolution of pyrite slurries upon electrolysis led to formation of ferric and sulfate ions in the anode. Depolarization of water by pyrite resulted in production of hydrogen gas with Faradaic current efficiencies of over 95% in the cathode compartment. Cyclic voltammograms of pyrite slurries suggest that dissolved iron in the electrolyte is responsible for the major portion of the electrochemical activity of pyrite. Electrooxidation of pyrite is found to be autocatalytic in nature. A comparison between the electrochemical oxidation of pyrite and coal slurries suggests that, although iron leached out from coal in the electrolyte is responsible for a significant amount of sulfur removal, in large concentrations iron can readsorb on the coal surface, resulting in poor sulfur removals.

10910 **(DOE/MC/20122—T1) Conceptual design and economic analysis for the manufacture of an ultra-clean coal/water mixture. Final report.** (United Coal Co., Bristol, VA (USA)). Sep 1984. Contract AC21-83MC20122. 44p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85005326.

This is the final report on the conceptual process design as part of the project on The Development, Testing, and Manufacture

of an Ultra-Clean Coal/Water Mixture (UCCWM) conducted under sponsorship of Morgantown Energy Technology Center of the US Department of Energy. The objective of the conceptual process design is to develop the cost production of an ultra-clean coal/water mixture based upon its specification of less than 1% ash, less than 44 micron top particle size with minimum 60% coal loading. To meet the required specification, Elkhorn seam coal, one of the lowest inherent ash coals, which is produced in the Eastern Kentucky area, was selected and cleaned by a two-stage physical process: (a) heavy media washer near 1.30 specific gravity separation, and (b) column flotation after grinding the heavy media washer product by a ball mill to -100 mesh. In order to micronize the coal/water mixture, the flotation product was processed through a stirred ball mill. The capacity basis of the coal cleaning and slurry manufacturing plant was to supply the UCCWM fuel for operating a typical 100 MW gas turbine continuously. The raw coal feed rate to the cleaning plant was 300 tons per hour and the final UCCWM fuel production was 70 tons per hour by dry coal basis. In addition to that, two by-products, boiler grade CWM and 1/4 inch x 0 coal are obtained. Economic analysis showed that the total capital cost for the plant was $30,614,000 and the final gas turbine grade CWM cost estimate was $3.96/MBtu in 1984 dollars F.O.B. plant. If we assume that the potential market for the fuel is located in the Northeastern United States, the delivered fuel is estimated to be $5.44/MBtu. 2 references, 1 figure, 9 tables.

10911 **(DOE/PC/60806—T2) Preparation of super-clean coal. Technical progress report for third and fourth quarters, March 15, 1984-September 14, 1984.** Yonn, R.H.; Adel, G.T.; Luttrell, G.H. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Dept. of Mining and Minerals Engineering). 1984. Contract FG22-83PC60806. 27p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85003708.

To better understand the fundamental steps involved in the froth flotation process, the collection efficiencies for the flotation of a very hydrophobic, ash-free coal sample have been determined. The results show that the collection efficiency increases drastically with decreasing bubble size, as predicted from a hydrodynamic model proposed by Weber and Paddock (1983). A mathematical model has been developed in the present work to predict the rate constant as a function of bubble size using theoretical collision efficiency values. The experimental rate constants determined in the present work, using a run-of-mine coal, exhibit a power relationship predicted from the model, but the values are lower than the model predictions by approximately 35 to 45%. This discrepancy may be attributed to other efficiency terms, e.g., adhesion efficiency, not considered in this model. 5 references, 9 figures.

10912 **(DOE/PC/63048—T1) LICADO process for super-clean coal. Quarterly report, October-December 1983.** Morsi, B.I.; Klinzing, G.E.; Chiang, S.H.; He, D.; Araujo, G.; Chen, S. (Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering). Dec 1983. Contract AC22-83PC63048. 23p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004236.

During the first quarter, the design and construction of a bench-scale experimental unit for the LICADO process was completed. This unit was successfully pressure-tested and used for preliminary experimentation. Initial results indicated that run-of-mine coal can be cleaned by this non-aqueous process. The ash content of the clean coal product was reduced to as low as 1.6% from a feed coal containing 7.6% ash (Illinois No. 6 Coal). In addition, a pressurized equilibrium cell was constructed for the determination of physical properties of CO_2-H_2O-Coal mixture. 3 references, 1 table.

10913 **(IS-T—1091) Coal cleaning by froth flotation.** Han, C. (Ames Lab., IA (USA)). Jan 1984. Contract W-7405-ENG-82. 240p. NTIS, PC A11/MF A01; GPO Dep. File Number DE85005624.

Thesis.

A number of experiments were conducted to determine the flotation characteristics of Iowa coals in which various conditions were applied to study the effect of different parameters such as frother dosage, oily collectors, pyrite depressants, and various combinations of these reagents. Flotation tests were also conducted with Appalachian coals for comparison. Iowa coals did not respond as well to froth flotation as Appalachian coals. Although Iowa coal floated very flowly and incompletely with only a frother (methyl isobutyl carbinol or MIBC), it floated rapidly when a large dosage of an oily collector (No. 200 LLS fuel oil) was employed in addition. No. 1 fuel oil was not nearly as effective as a collector for this application. The order of addition of flotation reagents appeared very important for achieving a high recovery of Iowa coal. Appalachian coals floated rapidly with only a frother or an alkaline solution. A small amount of an oily collector increased the recovery of Appalachian coals significantly. The results of these flotation experiments showed that little mineral matter was removed when a high recovery was achieved. The use of ultrasonics did seem to improve mineral matter liberation. Bubble-particle attachment was studied from a theoretical view point. This study showed that the mechanism of attachment differs depending on the relative size of bubbles and particles. The study indicated that micro-bubbles could separate mineral matter from low rank coal more selectively than macro-bubbles could. A general kinetic model was proposed to represent the rate of flotation of coal. For two Appalachian coals, the model successfully represented the flotation kinetics of uniformly sized coal and for coal consisting of two sizes of particles. 115 references, 33 figures, 34 tables.

10914 **(NERDDP-EG—82-85) Oil agglomeration: fundamental studies.** Healy, T.W. (National Energy Research, Development and Demonstration Council, Canberra (Australia)). 1982. 182p. National Energy Research, Development and Demonstration Council, Canberra, Australia .

Oil agglomeration recovery of coal/water suspensions is an economically attractive process to recover fine coal and recycle water to the coal washery. The kinetics of the preagglomerating step are shown to be critical in the efficient utilization of the minimum amount of oil to provide strong dense nuclei for subsequent growth. Supporting fundamental studies on the mechanism of 'particle set' at interactions and of the formation of oil in water emulsions have delineated the important thermodynamic criteria for processing fine coal/oil/water systems.

10915 **(NERDDP-EG—83-122) Coal washery reject disposal.** Stockton, N.D. (National Energy Research, Development and Demonstration Council, Canberra (Australia)). 1983. 882p. National Energy Research, Development and Demonstration Council, Canberra, Australia.

Studies on fine coal recovery, mechanical dewatering of tailings and emplacement of mixed coarse rejects and tailings all point towards a need to minimise reject volumes. Greater attention to fine coal recovery is encouraged to achieve this objective. The loss of fine coal of steaming specification in 1979 amounted to 2 million tonnes in some 4.8 million tonnes of tailings. Current interest in fine coal recovery techniques such as spirals, dense medium cyclones, water washing cyclones, improved flotation circuits and oil agglomeration together with on-stream analysis and automatic process control could greatly reduce the losses of fine coal. This report presents ways in which this could be achieved.

10916 **(NERDDP-EG—83-126) Improved recovery of fine coal.** Burdon, R.G.; Partridge, A.C.; Yan, D.S.; Ng, F.L.; Kartawijaya, A.S.; Willard, A.G. (National Energy Research, Development and Demonstration Council, Canberra (Australia)). 1983. 297p. National Energy Research, Development and Demonstration Council, Canberra, Australia.

A study was made of the surface characteristics of coals having a low response to froth flotation, in an attempt to improve the flotation response of fine coals. The recovery of fine coal particles using various oils and surfactants was investigated, based upon data obtained from contact angle measurements, interfacial tension measurements, and examination of electrokinetic properties of some coals. The influence of particle size distribution of magnetite on the performance of a heavy medium cyclone circuit was also studied. The characterisation of fine coal by image analysis is discussed, and techniques have been developed to identify constituents especially the spatial distribution of mineral matter in coal.

10917 (NERDDP-EG—83-149) Coal cleaning by flotation. Bennett, A.J.R.; Bustamante, H.; Shibaoka, M.; Telfer, A.; Warren, L.J.; Woods, G. (National Energy Research, Development and Demonstration Council, Canberra (Australia)). 1983. 149p. National Energy Research, Development and Demonstration Council, Canberra, Australia.

The overall objective of the work was to improve the recovery of coal by flotation by establishing an understanding of the coal/water interface, the mechanisms of attachment of flotation collectors, and the dynamic nature of grain/bubble contacts. In order to achieve the objectives the following lines of research were undertaken: (1) The effect of grain size on the flotation recovery of four Australian bituminous coals of high and low rank were studied in the presence of isobutylcarbinol and frother, without and with kerosene as collector. (2) Batch flotation tests on Great Northern and Wongawilli coals were carried out. Size fractions of both concentrates and tailings were separated into different relative density subfractions and their flotabilities determined. (3) Flotation products were characterised in terms of the association between macerals and/or mineral matter with a technique called grain type analysis, which was developed during the course of this project. (4) Laboratory batch flotation on coals of differing rank were carried out and the flotation products analysed by the grain type analysis to determine the relative flotabilities of the different grain types. (5) The dynamics and efficiency of collision between bubbles and coal grains of different size was determined by high speed cinephotography. (6) Batch flotation tests were carried out on fresh and weathered Great Northern coal in the presence of dodecylamine as collector and MIBC as frother. The electrokinetic behaviour of the coals in aqueous solutions and in the presence of surfactants were determined. Adsorption isothermas of dodecylamine, dodecyltrimethylammonium chloride and sodium dodecylsulfate were measured.

10918 (NERDDP-EG—83-175) Dense phase pneumatic conveying of pulverised coal. Arnold, P.C.; McLean, A.G.; Wypych, P.W. (National Energy Research, Development and Demonstration Council, Canberra (Australia)). 1983. 34p. National Energy Research, Development and Demonstration Council, Canberra, Australia.

Research work concerning the dense phase pneumatic transport of pulverised coal and fly ash is currently being conducted in the Bulk Solids Handling Laboratory at the University of Wollongong. A convenient method for presenting the variation of major dense phase pneumatic conveying parameters is needed for efficient design and system evaluation. One suggested technique has been established. Relevant scale up procedures for industrial applications have also been determined. Flow transient responses from a well instrumented test rig have indicated the importance of particular conveying for purposes of efficient transportation and solids flow control.

10919 (HSE-Trans—8644) Safety regulations for coal and oil shale mines, Moscow - 1973, Chapter IV: Road haulage and shaft winding. 2. Manriding and transport of persons and material in level workings . (Health and Safety Executive, London (UK)). Aug 1979. Translation source information not available . 12p. NTIS (US Sales Only), PC A02. File Number DE85900538.

The regulations are very detailed and specific, with many prohibitions and daily checks of various items before operation. (LTN)

0140 Combustion

REFER ALSO TO CITATION(S) 01400010835, 10878, 10880, 11013

10920 (CONF-8404201—9) Update on operating performance of the Battelle Multisolid Fluidized-Bed Combustion process. Litt, R.D.; Conner, J.G. (Battelle Columbus Labs., OH (USA)). 1984. 11p. University of Kentucky, 112 Frazer Hall, Lexington, KY. File Number TI85900886.

From 23. annual Kentucky industrial coal conference; Lexington, KY, USA (11 Apr 1984).

Battelle has developed and is commercializing an advanced circulating fluidized-bed combustion process, referred to as Multisolid Fluidized Bed Combustion (MSFBC), to burn a variety of fuels with low levels of flue gas pollutants. The primary fuel of interest has been high-sulfur coal, but many other fuels have also been burned in the process with excellent results. Fuel flexibility is rapidly becoming a significant factor in the industrial acceptance of fluidized beds. The process, which is capable of burning several fuels while meeting stringent flue gas emission requirements, has significant potential economic benefit, especially if one of the fuels is a waste stream or a low quality/low cost fuel. 6 references, 2 figures, 3 tables.

10921 (CONF-8404201—10) First-year's operation of a full-scale second-generation FBC in an industrial plant. Baty, G.B. (Wormser Engineering, Inc., Woburn, MA (USA)). 1984. 22p. University of Kentucky, 112 Frazer Hall, Lexington, KY. File Number TI85900896.

From 23. annual Kentucky industrial coal conference; Lexington, KY, USA (11 Apr 1984).

Data related to the operation of a two stage coal fired fluidized bed boiler installed for Iowa Beef Processors, Inc. Amarillo, Texas are presented. This steam generator, which has a rating of 70,000 lb/hr steam, 650 psig, is the large privately funded fluidized bed coal combustion installation in the United States. The facility includes a dual bed combustor, whereby the coal is burned in a lower bed containing steam tubes and sulfur dioxide is collected in an upper bed containing dolomite. Coal burns predominantly in the lower bed at relatively high temperatures while combustion is completed in the upper bed. The upper bed also improves sulfur capture by reacting with SO_2 generated in the freeboard, which would be difficult to capture in early designs for FBC packaged boilers. The two stage concept provides high combustion efficiency, low NO/sub X/ emissions, and high sulfur capture. The results of recent measurements of emissions of sulfur dioxide will be included in this presentation. 4 figures.

10922 (DOE/FE/60339—T7, pp 60-62) Use of fluidized bed coal combustion techniques to study efficiency, emission reduction, boiler effects, and waste utilization. Hesketh, H.E.; Rajan, S.; Miyasaka, K. 26 Oct 1984. NTIS, PC A04/MF A01. File Number DE85000035.

In High-sulfur coal research at the SIUC Coal Technology Center. Quarterly report, July 1-September 30, 1984.

The objectives were (1) to select and prepare low-grade coal samples or acquisition of thermodynamic data in the laboratory scale AFBC combustor; and (2) to install the pilot scale 100 lb/hr York-Shipley combustor in the Coal Technology Laboratory. Sample coals from gob pile wastes and mine tailings have been selected and analyzed preparatory to testing the bench scale fluidized bed combustor. Gas analyzers for continuous monitoring of CO, CO_2, and O_2 have been added to the existing instrumentation and are being calibrated. Progress is being made toward testing of the low-grade coals in the laboratory unit. The major components of the York-Shipley 100 lb/hr pilot scale FBC unit have been installed and checked out. Firing tests of the unit for proper performance verification are about to begin.

10923 (DOE/FE/60339—T7, pp 68-73) Fine particle coal as a source of energy in small user applications. Davis, P.K.; Rajan, S.; Mitchell, T.M. 26 Oct 1984. NTIS, PC A04/MF A01. File Number DE85000035.

In High-sulfur coal research at the SIUC Coal Technology Center. Quarterly report, July 1-September 30, 1984.

The objectives of this research are these: (1) to detemine the technical and economic feasibility of using fine particle coal, either in the form of coal-water mixtures or in the dry powdered state in small user applications, including commercial and residential; and (2) if this proves feasible, to identify the problems that need to be researched. The literature search is progressing rapidly as many articles are being accumulated and problem areas will later be identified. The utilization of powdered coal or coal slurries in small-scale applications appears attractive but needs particualr attention to burner design and operational characteristics. An area of further research is the development of an atomizer/burner that could burn powdered coal or a coal slurry on an intermittent basis with reliability and stability of operation.

10924 **(DOE/MC/20228—T1) Coal water mixture combustion in Multiannular Swirl Burner (MASB). Low Emission Combustor Technology Program. Draft.** Lew, H.G.; Toof, J.L. (Westinghouse Electric Corp., Concordville, PA (USA). Combustion Turbine Systems Div.). Sep 1984. Contract AC21-82MC20228. 60p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85005412.

The work described in this report is part of the DOE/METC Low Emission Combustor Technology Program to evaluate coal water mixture (CWM) in a low emission staged rich-lean combustor, the Multiannular Swirl Burner (MASB), for stationary combustion turbines. This Topical Report contains the results of the last set of combustion tests of this combustor with the fuels of coal water mixture (CWM) and methane. This set of tests includes the testing of the cooled deposition pin designed for ash deposition measurements and a particulate sampling probe. Preliminary collection of particulates and pin deposits was made. Combustion test results for CWM with a methane pilot show the high combustion efficiencies up to 88%. All test results including those reported earlier show that efficiencies up to 99.5% are obtained for CWM and methane mixture for this combustor. Results reported here indicate that CWM with only 50% solid loading is a marginal fuel at the heat release rates being attempted for this metal wall combustor and that a higher heat content fuel is required.

10925 **(DOE/PC/70775—1) Synthetic chars for studies of char combustion mechanism. Quarterly technical progress report, September 1-December 1, 1984.** Flagan, R.C. (California Inst. of Tech., Pasadena (USA)). 4 Jan 1985. Contract FG22-84PC70775. 2p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005216.

During this initial phase of the program, work has focused on: (1) construction and testing of a two-color optical pyrometer telescope for measuring the temperature histories of individual burning char particles in a laminar flow reactor; (2) design of a system for the production of uniformly sized synthetic char particles; and (3) design of a new flow reactor in which combustion experiments will be carried out. The production of monodisperse synthetic char particles will be based upon a vibrating orifice aerosol generator, a device which is commonly used for generating calibration particles for aerosol studies. The atomization of high viscosity slurries to produce large particles is the subject of preliminary experiments.

10926 **(NERDDP-EG—83-70) Coal firing of the Sirosmelt reactors.** Denholm, W.T.; Taylor, R.N. (National Energy Research, Development and Demonstration Council, Canberra (Australia)). 1983. 56p. National Energy Research, Development and Demonstration Council, Canberra, Australia.

A simple system was developed for feeding pulverised coal to top entry lances used in submerged combustion smelting operations. The system comprises a mechanically fluidised gravimetric screw feeder which delivers coal at ambient pressure to a pneumatic injector. The coal is entrained in carrier gas and delivered at increased pressure via an antistatic hose to a central fuel pipe in the lance, from which it is extracted by an eductor near the tip of the lance and mixes into the high velocity combustion/air stream flowing in the outer annulus. Combustion occurs at the submerged open end of the lance tube in the high temperature bath. A coal fired lance was successfully used in a copper smelting trial in the 50 kg Sirosmelt Reactor, at the CSIRO Division of Mineral Engineering. It is recommended that further development be done on a larger scale in collaboration with industry.

10927 **(NERDDP-EG—83-135) Formation of nitrogen oxides from the combustion of Yallourn brown coal.** Cliff, D.I. (National Energy Research, Development and Demonstration Council, Canberra (Australia)). 1983. 59p. National Energy Research, Development and Demonstration Council, Canberra, Australia.

The aim of this project was to determine and elucidate the physicochemical factors controlling NO/SUB/x generation during the combustion of brown coal. Initially the combustion of the volatile component of Yallourn brown coal was studied using a premixed hydrogen/oxygen/nitrogen or argon flame. Under fuel lean conditions these experiments indicated that the rate of NO/SUB/x formation is independent of temperature and oxygen partial pressure, and the evolution of NO/SUB/x and CO/SUB/2 from the volatile combustion region directly proportional to one another. The second phase of research involved flash pyrolysis of a Yallourn brown coal in order to evaluate the products as a function of temperature. The heating rate and residence time were comparable with those found in a normal coal-fired boiler. The elemental variation in these components was also studied as a function of temperature, in the range 400 to 1000 degrees C. With particular relevance to NO/SUB/x formation, the fuel nitrogen was 90% volatilised by 1000 degrees C and would probably be completely volatilised well below normal coal combustion temperatures.

10928 **(NERDDP-EG—83-160) Combustion and heat transfer in pulverised coal fired furnaces.** Wall, T.F.; Wibberley, L.J.; Truelove, J.S. (National Energy Research, Development and Demonstration Council, Canberra (Australia)). 1983. 11p. National Energy Research, Development and Demonstration Council, Canberra, Australia.

Three related aspects of combustion and heat transfer in pulverised fuel furnaces were studied: combustion and burner aerodynamics and modelling, heat transfer modelling, including the development of techniques for the measurement and prediction of inputs; the radiative properties of fly ash; and studies on mechanisms of ash fouling. Additional topics covered were the effect of sulphur on electrostatic collection of ash, and the emissivity of ash surfaces. Included in the report is an extensive bibliography of literature published as a result of this study.

10929 **(NERDDP-EG—83-164) Aerodynamics of burner jets designed for brown coal fired boilers.** Perry, J.H.; Hausler, T. (National Energy Research, Development and Demonstration Council, Canberra (Australia)). 1982. 73p. National Energy Research, Development and Demonstration Council, Canberra, Australia.

An experimental investigation into the aerodynamics of burner jets designed for brown coal fired boilers is described. Following an extensive literature survey a number of burner geometries have been characterised including a single near rectangular jet, three jets discharging at right angles to the furnace wall, the three jet system discharging at an angle to the wall with the jet dividers terminating at the boiler wall then upstream, and finally a recessed burner with divergent recess walls. Experimental data cover a wide range of secondary to primary jet velocity ratios and include flow visualisation observations and transverse velocity profile and surface static pressure measurements. A mathematical model of the jet flow field has been developed. This covers a numerical solution to a general non-linear parabolic system with closure achieved using a (k-e) turbulence model. This work is continuing.

0150 Marketing And Economics

REFER ALSO TO CITATION(S) 01500010866, 11214, 11215

10930 **(DOE/EIA—0121(84/3Q)) Quarterly coal report, July-September 1984.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). Jan 1985. 101p. NTIS, PC A06/MF A01; 1 - GPO; GPO Dep. File Number DE85006484.

This report provides comprehensive information about coal production, exports, imports, receipts, consumption, and stocks in the United States during the quarter ending September, 1984. US coal production and consumption climbed to record heights during the 3 months preceeding the September 30, 1984, contract expiration of the United Mine Workers of America. The vigorous growth over the first 9 months is projected to lead to a production high of 890.1 million short tons in 1984. Third quarter 1984 data showed that: coal production established a record quarterly high of 242.9 million short tons; coal exports climbed 6.4% above the second quarter level, bringing the total for the first 9 months 11.5% ahead of the previous year's pace; domestic coal consumption reached quarterly and 9-month record highs; consumer stockpiles reached their highest level since the first quarter of 1981; and coal consumption at coke plants dropped 8.7% after 6 consecutive quarterly in-

creases. Coal output reached 242.9 million short tons in the third quarter of 1984, surpassing the previous production high of 238.2 million short tons in the fourth quarter of 1981. Production increased from the second to the third quarter of 1984 in each region: Appalachia (3.7%), the Interior Region (5.9%), and particularly the Western Region (13.4%), which accounted for over half of the total rise in production. 14 figures, 54 tables.

10931 (DOE/FE/60339—T7, pp 63-67) **Critical points in the coal fuel cycle: continued modeling analysis.** Arey, D.; Baumann, D.; Dziegielewski, B.; Crenshaw, J.; Parker, G.; Primont, D. 26 Oct 1984. NTIS, PC A04/MF A01. File Number DE85000035.

In High-sulfur coal research at the SIUC Coal Technology Center. Quarterly report, July 1-September 30, 1984.

Computer simulation models of coal markets are used to forecast the impacts of innovations in coal technology and changes in legislation which affect coal distribution and use. The model we have chosen to examine is the DOE Coal Supply and Transportation Model (CSTM). In addition, the modeling project is exploring the use of this model in policy analysis. The modeling project is modifying and customizing the CSTM in terms of input data on supply curves, coal preparation, scrubbing costs, transportation rates, and benefits and costs of environmental quality regulations as these apply to the coal fuel cycle. Linkage and complementary research with the Universities Research Group on Energy is being undertaken. A user group for the CTL version of the CSTM is being developed, and a user-friendly manual will be produced for use of the model.

10932 (NERDDP-EG—83-76) **Planning framework for the accommodation for coal development by Wollongong City.** (National Energy Research, Development and Demonstration Council, Canberra (Australia)). 1983. 365p. National Energy Research, Development and Demonstration Council, Canberra, Australia.

The major objectives of this study are to determine the significance of the coal mining industry for Wollongong City, and to provide Wollongong City with a framework for accommodating development related to the coal industry. In this first stage of the study, the significance of the coal industry to Wollongong City is broadly analysed. The results of this examination illustrate that the coal industry has a significant impact on the National, State and Local economies. Transportation has played a major role in facilitating or inhibiting the development of the coal industry over time. It is expected that transportation inputs will continue to be a major factor in the economic development of the coal, and iron and steel industries. In this context, existing transportation conditions in the study area are examined and future needs estimated. Part one therefore provides the basis for part two which examines formulation of a short term coal haulage strategy, environmental impact assessment of short and long term strategies including description of the present environment affected by the strategies, identification of environmental safeguards to be incorporated into the strategies, sources of finance, and formulation of a plan to provide council with a comprehensive approach in dealing with impacts of coal transport in a time framework.

0160 Health And Safety

REFER ALSO TO CITATION(S) 01600010897, 10901, 10919, 11694

10933 **Pulmonary toxicity of inhaled coal liquid aerosols (boiling range 230-450°C).** Loscutoff, S.M.; Killand, B.W.; Miller, R.A.; Buschbom, R.L.; Springer, D.L.; Mahlum, D.D. (Pacific Northwest Lab., Richland, WA). *Toxicology and Applied Pharmacology;* **67**: 346-356(1983). Contract AC06-76RL01830.

The biological activity of materials produced in the direct liquefaction of coal is being assessed by a variety of test systems. In this study, the pulmonary toxicity of process solvent (PS) from the solvent refined coal-I (SRC-I) process was determined by histamine aerosol challenge tests and pulmonary function and morphologic evaluations. Guinea pigs inhaled aerosols of PS (boiling range, 230 to 450°C) for 6 hr/day, 5 days/week, for up to 12 days in three different experiments. In the first experiment, 8-week-old animals inhaled 0 (controls), 0.15, or 0.60 mg/liter PS aerosols with a mass median aerodynamic diameter (MMAD) of 1.3 μm. Exposure to 0.15 mg/liter PS for 12 days resulted in depressed weight gain and marked hypersensitivity to inhaled histamine compared with sham-exposed control animals. Four of five animals exposed to 0.6 mg/liter PS died of respiratory failure during exposure. During the second experiment, 14-week-old animals inhaled 0 (contols) or 0.19 mg/liter PS (MMAD, 1.3 μm) for 1, 3, or 12 days. Hypersensitivity to aerosolized histamine occurred only after 12 days exposure to PS aerosols. At that time, morphologic lung evaluations showed mild to moderate pneumonitis and accumulation of exudate in bronchioles of PS-exposed animals. In the third experiment, pulmonary function evaluations were conducted on 4-week-old animals exposed to 0 (controls) or 0.19 mg/liter PS for 8 days. Functional changes measured in these animals (compared to controls) included increased gas trapping at low lung volumes, decreased quasi-static compliance, and decreased diffusion capacity of the lung for carbon monoxide.

0170 Legislation And Regulations

REFER ALSO TO CITATION(S) 01700010873, 10919

02 PETROLEUM

0202 Geology And Exploration

10934 (DOE/EI/06540—T1) **Volume and area of oil fields and their impact on order of discovery.** Bloomfield, P.; Deffeyes, K.S.; Silverman, B.; Watson, G.S.; Benjamini, Y.; Stine, R.A. (Princeton Univ., NJ (USA)). Jan 1980. Contract AS01-78EI06540. 54p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85005649.

There is a tendency for the large oil fields in an area to be discovered and developed earlier than the small fields. Estimates of the undiscovered oil in the area must allow for this effect. The relationship between the volumes and areas of oil fields, and their impacts on the order of discovery of fields, are important in most of the discovery process. Data on the date of discovery, area, and cumulative production of oil fields in Kansas are examined to describe these phenomena. Since the area of an oil field is commonly used in discovery models, but volume is the quantity of interest in resource estimation, it is desirable to determine the relationship between these quantities. A significant but weak linear relationship was found between the logarithms of cumulative productions (used as a measure of volume) and area for the Kansas data. The relationship is of little value for predicting cumulative production from area, for these data. Some models also incorporate the statistical distribution of areas and volumes of oil fields. For the Kansas data, the distribution of volumes is close to lognormal, but the distribution of areas is not so close. It is sometimes assumed that the probability of discovery of a field is proportional to its area. This is shown to be untenable for the Kansas data. The discoverability was found, instead, to be proportional to a surprisingly low power of area. The results of these analyses are, of course, limited to the Kansas data. However, the techniques could be applied to data from other areas. The results from Kansas indicates that the techniques can give useful and unexpected insights. They indicate that models assuming that discoverability is proportional to either area or volume should not be used on a regional basis without further study along the lines of this report. 7 references, 27 figures, 4 tables.

0203 Drilling And Production

REFER ALSO TO CITATION(S) 02030011639

10935 (DOE/BC—84/3) **Contracts for field projects and supporting research on enhanced oil recovery. Progress Review No. 39, quarter ending June 30, 1984.** Linville, B. (ed.). (USDOE Bartlesville Project Office, OK (USA)). Dec 1984. 143p. NTIS, PC A07/MF A01; GPO Dep. File Number DE85000107.

Progress reports are presented for field tests and supporting research for the following: chemical flooding; gas displacement; thermal recovery/heavy oil; resource assessment technology; extraction technology; and microbial enhanced oil recovery.

10936 **(DOE/ET/13077—101) Commercial scale demonstration enhanced oil recovery by micellar-polymer flood. Technical progress report, November 1984.** Mueller, L.M. (Marathon Oil Co., Findlay, OH (USA)). 1984. Contract AC03-78ET13077. 64p. NTIS, PC A04. File Number DE85006483.

This report describes work conducted on the Maraflood oil recovery process, M-1 Project, throughout the month of November, 1984. Information is presented under two Work Breakdown Structure (WBS) elements: WBS 2100 - Fluid Injection and WBS 2300 - Performance Monitoring. Fluid Injection reporting includes a discussion of hydrogen peroxide stimulation of twelve 5.0-acre injection wells. Performance Monitoring reporting includes discussions of the 2.5-acre and 5.0-acre pattern oil cut performance for November, 1984, the October, 1984, high sulfonate content wells, and the October, 1984, tritiated water analysis. 16 figures.

10937 **(DOE/MC/16426—14) Mobility control for CO_2 injection (support for field project). Fourteenth quarterly report including project status report, August 17-November 17, 1984.** Heller, J.P. (New Mexico Inst. of Mining and Technology, Socorro (USA). New Mexico Petroleum Recovery Research Center). 10 Jan 1985. Contract AC21-81MC16426. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005617.

The goals of this contract have been: (1) to continue activities under a companion project, DE-AC21-79MC10689 (now completed), that was aimed at the development of mobility control additives or procedures in CO_2 floods, and to apply these to the particular problems of the Rock Creek Field; (2) to conduct additional laboratory tests designed to study the compatibility of Rock Creek oil, brine and reservoir rock with CO_2 and with other chemicals which might be involved in mobility-controlled CO_2 floods; (3) to provide support in the design of the field mobility control tests, themselves; and (4) to help in the assessment of field results, and in the design of tests to be used for such assessment. As was noted in the previous quarterly report, the first three of these objectives have been completed. Similarly, that portion of objective four dealing with the design of assessment methods for the mobility control experiment has also been completed. Since the issuance of our thirteenth quarterly, several new operational decisions have been made concerning these assessment methods. Although these modified procedures differ somewhat from those originally suggested, they can be more reliably and conveniently carried out in the field and can also be expected to yield useful information on the progress and effectiveness of the experiment. The mobility-controlled displacement experiment is currently underway, as is the sample analysis program. This report gives in detail the design changes made since the previous quarterly, as well as a chronology of events up to the time of writing. 1 figure.

10938 **(NIPER—23-Vol.1) Energy production research, Volume I. Monthly progress report for November 1984.** (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). 14 Dec 1984. Contract FC01-83FE60149. 33p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85004850.

Summaries are presented for the following research projects: (1) geoscience application to the prediction of reservoir variations; (2) reservoir screening and recovery predictions; (3) EOR environmental compatibility; (4) development of improved oil mobilization concepts; (5) gas miscible displacement method; (6) mobility control mechanisms of steamflooding additives; (7) improvements in stimulation technology; (8) steamflooding with additives; (9) recovery processes - chemical; and (10) development of improved immiscible gas displacement methodology. Some of the highlights for this period are: (1) for extremely low permeability core it was found that low pH-methanol and heptane prepads are effective in reducing formation damage and clean-up time, with heptane the most effective; (2) core from the coastal zone of MWX-1 has lower permeability than those in the palludal zone, and take longer to clean up; (3) coreflood experiments with microbes showed that the pressure in the core can increase by 20 to 40 psi within 48 hours, indicating that gas generated by microbes can provide energy to mobilize oil; (4) in situ generation of blocking emulsion in Berea core was found to be able to reduce permeability of the core, injection of externally produced emulsion reduced the permeability by an additional 43%; and (5) an accurate correlation for CO_2 viscosity has been successfully developed. This correlation can predict CO_2 viscosity with +- 2%.

0206 Health And Safety

REFER ALSO TO CITATION(S) 02060011694

10939 **Cancer risk among oil-refinery workers: a review of epidemiologic studies.** Savitz, D.A.; Moure, R. (Univ. of Colorado School of Medicine, Denver). *JOM, Journal of Occupational Medicine;* **26**: No. 9, 662-670(Sep 1984). Contract AC02-82ER60087.

The possibility that excess cancers result from occupational exposures in oil refineries has generated a great deal of interest. Ecological studies and case-control studies in the general population have suggested a positive association between oil industry activity and cancer rates, with more direct evidence provided by studies of refinery employees. The eight investigations of cancer risks among refinery employees are critically reviewed. The methodological strengths and weaknesses of these studies are evaluated with an emphasis on the likely impact on the results. While the results are markedly inconsistent across studies, there is some suggestion of excess risks for melanoma and for brain, stomach, kidney, and pancreatic cancers. Problems with exposure characterization, latency, and potential confounding factors limit all of the studies that were reviewed. 37 references, 9 tables.

0207 Marketing And Economics

REFER ALSO TO CITATION(S) 02070010934

10940 **(CONF-8405216—1) Replacement cost of domestic crude oil.** Kuuskraa, V.A.; Morra, F. Jr.; Hochheiser, H.W. (Lewin and Associates, Inc., Washington, DC (USA); USDOE, Washington, DC). May 1984. Contract AC01-75ET12536. 43p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85004508.

From AAPG annual convention; San Antonio, TX, USA (20 May 1984).

The United States has a rich base of petroleum resources, but replacing domestic oil reserves will be costly and will require advances in technology. In the mature onshore and offshore regions, the bulk of the future oil will be found in small fields. The promise of large discoveries lies in the costly and challenging deep offshore waters and the hostile Arctic. With significant investment in R and D, advanced tertiary recovery methods could also make a major contribution to lower-cost domestic supplies. The study of the replacement costs of domestic crude oil shows that adequate supplies of lower cost oil could be available through the middle of the 1990s. However, as these lower-cost sources are depleted, replacement costs will begin to escalate rapidly reaching very high levels after the turn of the century. Geology, policy choices, and investment decisions can significantly alter the future shape of the replacement cost curve. Lower than expected exploratory success in the Arctic and the deep offshore waters, or constraints on lease sales would dramatically increase reserves replacement cost. On the other hand, increased access to resources and advances in oil exploration and recovery technology would sharply lower the replacement cost curve and provide substantial benefits to the industry and the US economy. 16 references, 1 table.

10941 **(DOE/EIA—0380(84/10)) Petroleum Marketing Monthly, October 1984.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). Jan 1985. 137p. NTIS, PC A07/MF A07; 1 - GPO; GPO Dep. File Number DE85005436.

This report presents monthly summaries of petroleum product statistics for the US, Petroleum Administration for Defense (PAD) Districts, and individual states. Four types of petroleum product statistics are included: sale prices, sale volumes, percentages of product sales, and first sales of products for consumption. Salient statistics are highlighted in a summary section, and each of the four subjects are treated in detail in other sections. The first three sections provide national-level statistics on sales of the various products to end-users and for resale. Data on motor gasoline, aviation fuel, jet engine fuel, kerosene, distillate fuel oils, residual fuel oils, and propane are included. The preliminary statistics for October 1984 show that total refiner/gas plant operator sales of selected petroleum products increased by 1.9% compared with final September sales. Increases in sales were reported for the four seasonal fuels (kerosene, No. 1 distillate, No. 2 fuel oil, and propane) as well as for unleaded and premium gasolines, No. 4 fuel oil, and high-sulfur residual fuel oil. Refiner/gas plant operator price changes were mixed in October. While most retail prices increased slightly, retail prices for aviation gasoline, No. 4 fuel oil, and propane declined. At the wholesale level, refiner/gas plant operator prices also declined for aviation gasoline, kerosene, and No. 4 fuel oil. The October sales activity for each of the major product groups is summarized.

0209 Environmental Aspects

REFER ALSO TO CITATION(S) 02090011640

10942 **(EPA—600/S4-84-055) Results of the Drilling Fluids Research Program sponsored by the Gulf Breeze Environmental Research Laboratory, 1976-1983, and their application to hazard assessment. Project summary.** Duke, T.W.; Parrish, P.R. (Environmental Protection Agency, Gulf Breeze, FL (USA). Environmental Research Lab.). Sep 1984. 4p. NTIS, PC A02/MF A01. File Number TI85900742.

This report summarizes a cooperative research program to evaluate the impact of drilling fluids on the marine environment. The report is divided into four sections: (1) a brief discussion of the uses and characteristics of drilling fluids; (2) a presentation of the results of the research program, including a review of pertinent publications resulting from the program, data derived from chemical and biological studies of used drilling fluid samples from the Gulf of Mexico and from laboratory studies with generic drilling fluids, a discussion of environmental concentrations, and a synthesis of fate and effects data obtained through the Adaptive Environmental Assessment (AEA) process; (3) recent reviews and reports; and (4) conclusions. 13 references.

10943 **(OCS/MMS—84-0023-Vol.1) Proposed Gulf of Alaska/Cook Inlet lease sale 88. Final environmental impact statement. Volume 1.** (Minerals Management Service, Anchorage, AK (USA). Alaska Outer Continental Shelf Region). Jul 1984. 615p. Alaska OCS Region, MMS, P.O. Box 101159, Anchorage, AK 99510. File Number TI85900549.

The leasing proposal consists of 10.40 million hectares (approximately 25 million acres) of outer continental shelf (OCS) lands. The 4796 blocks are located in the Gulf of Alaska/Cook Inlet Planning Areas in waters that are from 5 to 241 kilometers (3 to 150 miles) offshore. Most of this area lies shoreward of the 2000-meter isobath. If implemented, this lease sale is tentatively scheduled to be held in December 1984. All blocks offered pose some degree of pollution risk to the environment. The risk is related to adverse effects on the environment and other resource uses which may result from accidental or chronic oil spills. Socioeconomic effects from onshore development could have state, regional, and/or local implications. Several alternatives and mitigating measures may be applied which may reduce the type, occurrence, and extent of adverse effects associated with this proposal. Other measures, which are beyond the authority of this agency to apply, have also been identified. In spite of mitigating measures, some effects are considered unavoidable. For instance, if oil were discovered and produced, oil spills would be statistically probable, there would be some disturbance to fishery and wildlife values, and some onshore development could occur in undeveloped and/or wilderness areas. Alternatives to the proposed action are: no sale; modify the lease area by deferring approximately 685 blocks in the Shelikof Strait; modify the lease area by deferring approximately 465 blocks to provide five buffer zones approximately 15 miles wide around major wildlife concentration areas; modify the lease area by deferring approximately 137 blocks at the Hinchinbrook Entrance to Prince William Sound; modify the lease area by deferring approximately 86 blocks off Cape Fairweather; and delay the sale. 361 references; 68 figures; 75 tables.

10944 **(OCS/MMS—84-0023-Vol.2) Proposed Gulf of Alaska/Cook Inlet lease sale 88. Final environmental impact statement. Volume 2. Appendices.** (Minerals Management Service, Anchorage, AK (USA). Alaska Outer Continental Shelf Region). Jul 1984. 191p. Alaska OCS Region, MMS, P.O. Box 101159, Anchorage, AK 99510. File Number TI85900516.

Volume two contains appendices for: (1) summary of minimum- and maximum-case effects; (2) oil spill risk analysis; (3) Endangered Species Act Section 7 consultation documentation; (4) archeological analysis and supplement prepared by the Minerals Management Service; (5) Minerals Management Service Alaska OCS region studies program; (6) supporting tables and figures; (7) acronym glossary; (8) alternative energy sources as an alternative to the OCS program; (9) written comments received on DEIS; and (10) public hearing testimony on DEIS.

0210 Legislation And Regulation

REFER ALSO TO CITATION(S) 02100011213

10945 **(GAO/RCED—84-192) Evaluation of the Department of Energy's Economic Regulatory Administration Office in Tulsa, Oklahoma.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 25 Sep 1984. 11p. US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760. File Number TI85900704.

The operations of the Economic Regulatory Administration's (ERA's) Office in Tulsa, Oklahoma, were reviewed. We reviewed (1) the change in the management of audit cases involving alleged oil pricing violations, (2) ERA's basis for changing its treatment of crude oil transactions between crude oil producers and affiliated crude oil resellers, and (3) the justification for employee performance awards. We found that the change in the management of audit cases did not adversely impact the development and resolution of audit findings. We did not find any examples of audit findings being dropped or modified as a result of the change. We also found that ERA's basis for changing its treatment of crude oil transactions between crude oil producers and affiliated crude oil resellers was consistent with both the Department of Energy's (DOE's) regulations and a 1982 court decision involving similar transactions. Further, we found that employee performance awards were fully documented and made in accordance with DOE criteria for making such awards.

03 NATURAL GAS

0306 Marketing And Economics

10946 **(BNL—51830) Spot and futures markets for natural gas.** Levine, D. (Brookhaven National Lab., Upton, NY (USA)). Sep 1983. Contract AC02-76CH00016. 66p. NTIS, PC A04/MF A01. File Number DE85005634.

This paper examines the potential role of spot and futures markets for natural gas. The aspects discussed include how the markets may develop, who will use them, how regulatory and legislative changes will affect them, and what their effects on the natural gas industry will be. 110 references.

10947 **(DOE/EIA—0130(84/10)) Natural Gas Monthly, October 1984.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). Dec 1984. 224p. NTIS, PC A10/MF A01; 1 - GPO; GPO Dep. File Number DE85004717.

This report presents recent data and current estimates on the consumption, disposition, prices, storage, import, and export of natural gas in the USA for October 1984. Also included are operating and financial data for major interstate natural gas pipeline companies plus data on filings, ceiling prices and transportation under the Natural Gas Policy Act of 1978. Featured articles entitled Main Line Natural Gas Sales to Industrial Users, 1983, and Average Price of Natural Gas Delivered to Consumers, 1983 (Preliminary) are included. Dry gas production (wet marketed production minus extraction loss) during October 1984 was estimated at 1437 billion cubic feet (Bcf), 4.7% above October 1983 dry gas production. Consumption of natural gas during October 1984 was an estimated 1279 Bcf, 0.4% above the October 1983 level. Compared to the previous September, residential consumption was up 3.2%, commercial consumption down 6.8%, industrial consumption up 11.5%, and electric utility consumption down 2.7%. The volume of working gas in underground storage reservoirs at the end of October 1984 was 2.8% below the October 1983 level. The average wellhead price of natural gas in August 1984 was $2.60 per thousand cubic feet (Mcf). In August 1983, the average was $2.58 per Mcf. In October 1984, the average residential price of natural gas was $6.25 per Mcf. The comparable price in October 1983 was $6.10 per Mcf. The average wellhead (first sale) price for natural gas purchases projected for November 1984 by selected interstate pipeline companies was $2.82 per Mcf. 5 figures, 21 tables. (DMC)

10948 **(DOE/PE—0069) Increasing competition in the natural gas market.** (USDOE Assistant Secretary for Policy, Safety and Environment, Washington, DC). Jan 1985. 212p. NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE85004930.

In this second report, the major recent adjustments examined are growth in domestic spot market transactions, lower prices for Canadian gas imports, and lower projected prices for alternative oil supplies. With respect to current market conditions, the report concludes that natural gas prices are being held at artificially high levels by NGPA wellhead price controls, restricted access to available interstate pipeline capacity, rising transmission margins, and regulatory restrictions on gas-on-gas competition. Although the Federal Energy Regulatory Commission's (FERC) minimum bill rule (Order 380) and special marketing programs have increased competition, regulatory restrictions on spot sales programs and discriminatory behavior by gas pipelines limit competition, impede contract renegotiation, and deny residential and commercial consumers access to lower cost supplies. Therefore, the report recommends that regulatory restrictions on spot sales programs be removed and that steps be taken to increase access to available pipeline capacity. The report also recommends implementation of new rate designs encouraging pipeline companies to operate efficiently and to transmit accurate price signals. In assessing future market prospects under alternative policies, the report concludes that partial wellhead decontrol under the current law will increase competition and market flexibility, resulting in further real price declines from 1985 through 1987. The report also concludes that comprehensive deregulation, which consists of complete decontrol of wellhead prices, mandatory carriage, and repeal of demand restraints, would provide much greater benefits to the Nation and its consumers than would either decontrol under the NGPA or permanent extension of NGPA controls. 2 figures, 58 tables.

0308 Environmental Effects

REFER ALSO TO CITATION(S) 03080010942, 10943

0309 Artificial Stimulation

REFER ALSO TO CITATION(S) 03090010944

10949 **(DOE/FE—0046) Unconventional natural gas.** (USDOE Assistant Secretary for Fossil Energy, Washington, DC). Sep 1984. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005731.

Current gas reserves in the US amount to slightly more than 200 trillion cubic feet - only 12 years of supply at today's consumption rates. Optimism exists, however, that new gas supplies can be found. The US Geological Survey estimates that up to 600 trillion cubic feet of potential natural gas reserves could still be discovered in conventional geologic formations. Potentially huge quantities of gas could also be present in so-called unconventional gas deposits - natural gas locked in tightly-packed sandstone beds in the western and southern US, in shale formations in Appalachia, in the nation's abundant coal seams, and in the deep, brine-filled aquifers of the Gulf coast. Exploration has also revealed that natural gas may be trapped in ice-like crystals below the permafrost or beneath the seafloor, though the potential is still undetermined. The US Department of Energy is working with private companies and other government agencies to reduce the uncertainty surrounding the size of these gas formations and to develop effective methods of freeing the gas contained within them. The objective is to develop the basic knowledge and technology to unlock these unconventional resources whenever price and market demand warrants commercial investments. This pamphlet describes unconventional gas projects being conducted by the Department of Energy's Office of Fossil Energy. The geopressured aquifer program is conducted by the Department's Office of Conservation and Renewable Energy.

10950 **(DOE/MC/20370—1700) Proppant transport model. Final report.** Rybicki, E.F.; Clark, P.E.; Harfouche, E.H.; Tleel, R. (Tulsa Univ., OK (USA)). Dec 1984. Contract AC21-83MC20370. 159p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85001987.

A numerical model for hydraulic fracturing and proppant transport has been developed. The development of the model involves the representation of complex phenomena including the fracture geometry, fluid flow in the fracture, fluid leak-off into the formation and proppant transport and placement characteristics. While the problem is too complex to expect quantitative results, the objective is to be able to rank different hydraulic fracturing treatments in terms of their relative ability to place propping agents in the fracture. Selected cases were run with the model to examine the effect of hydraulic fracturing variables on the resulting fracture shape and proppant placement. The trends shown by the model are in agreement with the type of behavior expected and the model appears to be a useful tool for comparing and selecting fracture designs. An experimental study to better describe the proppant settling behavior in cross-linked fluids was also conducted. Both borate and metal ion cross-linked fluids were tested. The complex behavior of these fluids presented difficulties in rheologically characterizing them. The data obtained and the testing procedures are described. 21 references, 53 figures, 20 tables.

10951 **95 stimulations in 63 wells.** Horton, A.I. *Northeast Oil Reporter;* 2: No. 1, 63-73(Feb 1982).

Since 1976, extensive studies on the nature of the Eastern gas shales and the production potential from stimulated shale wells have been conducted through joint efforts of industry and the Department of Energy (DOE). Prior to development of this project, the conventional method of stimulating the shales was borehole shooting, and conventional hydraulic fracturing of the shale was just beginning. DOE-industry investigations under the Eastern Gas Shales Project have experimented with other types of stimulations, including massive hydraulic fracturing, foam fracturing, cryogenic fracturing, chemical explosives, and novel treatments. Two of the latter have used (1) nitrogen and (2) oil assisted with nitrogen. Two

other treatments, which were unsuccessful, were (1) an open hole packer-stage frac and (2) a kerosene frac. These were operational and conceptual failures. Details of the stimulations and production data, where available, have been complied and studied. The experience that has been gained may prove helpful to those considering stimulation technology in future well drilling ventures in the shale. However, the limited data available in regions of similar geologic factors preclude a thorough analysis of stimulation effectiveness.

10952 **Devonian production needs stimulation.** Conkel, D. *Northeast Oil Reporter;* 2: No. 1, 58-62(Feb 1982).

The diverse elements of water, oil, alcohol, liquefied petroleum gas, foam, and dynamite have been used at one time or another to fracture of stimulate production from a well, and have had varying degrees of success. E.I.Dupont de Nemours and Co., Inc., has a product which surpasses all of the aforementioned. Dupont has developed a water-gel explosive called EL836 which has increased initial flow rates to twice that of wells stimulated with conventional dynamite. Dupont recently conducted tests on wells in Putnam County, W.Va., in cooperation with Cabot Oil and Gas Corp. and the Department of Energy, to gage the effectiveness of El836. The advantages and disadvantages of EL836 are discussed.

0310 Legislation And Regulation

REFER ALSO TO CITATION(S) 03100010948

0320 Transport, Pipelines, And Handling

10953 **(DOE/IR/10297—T2) Rate-of-return regulation and efficiency: the economics of the natural gas pipeline and distribution industry.** Samuelson, R.D. (Stanford Univ., CA (USA). Energy Modeling Forum). Apr 1984. Contract FG01-79IR10297. 319p. NTIS, PC A14/MF A01; GPO Dep. File Number DE85006476.

This study is an examination of how natural gas pipeline and distribution company efficiency may be affected by three policy instruments at the disposal of regulators under a system of rate-of-return regulation with wellhead price controls. The three policy instruments to be considered are the regulator's powers to set the allowed rate-of-return, to approve or deny new capital investments, and to set the wellhead price. The study considers the likely effect of these instruments on both the efficiency of the firm's capital investment strategies, and the efficiency with which the firm conducts its operations. The objective is to give regulatory decision-makers an improved awareness of the consequences of their actions, so as to allow more enlightened regulatory policies. Although the study focuses on the natural gas pipeline and distribution industries, many of the results are generally applicable to any rate-of-return regulated firm. 39 figures, 9 tables.

04 OIL SHALES AND TAR SANDS

0403 Drilling, Fracturing, And Mining

10954 **(DOE/RA/32012—T27) Naval Oil Shale Reserves 1 and 3. Five years of progress on the Oil Shale Predevelopment Program: summary.** (TRW Energy Engineering Div., McLean, VA (USA)). Jun 1982. Contract AC01-78RA32012. 111p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85005451.

This report summarizes the predevelopment work done to date, and discusses the work remaining to be accomplished for the policy options pertaining to continuing developmental activities. The work can be divided into three technical areas: resource assessment, technology assessment, and environmental assessment. The resource assessment results show that NOSR 1 could sustain a production rate of 50,000 barrels per day for well over 100 years. NOSR 1 has the largest in-place resource, the third largest recoverable resource, comparable recovery economics, a greater recovery potential with improvements in low-grade recovery technology, and fewer technical, environmental, and institutional impediments to development. An assessment of six mining technologies showed that the only option technically and economically feasible was room and pillar mining. There are approximately 17 options for retorting shale available for screening. These options fall broadly into the categories of surface and in situ retorting, solvent processing, and bioleaching. Processes retained after initial screening consist of only surface retorting options: Lurgi-Ruhrgas, Paraho, Tosco II, Union B, and Superior Circular Grate. Surface retorting is also planned for all nearby oil shale projects. Environmental assessment has focused on two major thrusts: environmental baseline determination and preparation of a programmatic Environmental Impact Statement (EIS). 17 figures, 11 tables. (DMC)

0404 Oil Production, Recovery, And Refining

REFER ALSO TO CITATION(S) 04040010954, 10955

0407 Health And Safety

REFER ALSO TO CITATION(S) 04070011694

0410 Enviromental Aspects

REFER ALSO TO CITATION(S) 04100010954

10955 **(DOE/LC/10747—T10) BX In Situ Oil Shale Project. Environmental Mitigation and Monitoring Plan (revised September 1981).** Dougan, P.M. . (VTN Consolidated, Inc., Irvine, CA (USA)). 20 Dec 1981. Contract FC20-78LC10747. 60p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85006462.

The purpose of this document is to describe the Environmental Plan which was designed to assess the environmental aspects of Equity's in situ oil shale project. Although the project is of pilot scale, the plan was designed so that the data can be used to assess the potential environmental impact of possible future commercial development. The project and the environmentally oriented work to be done under the project are discussed. The section has been segmented such that for each subprogram, i.e., Air Resources, Water Resources and Aquatic Biology, the program background, purpose, objectives and research needs are presented. Also included in the program discussions is a presentation of the applicable Federal, state and local regulatory requirements. Another section details the environmental mitigation and monitoring reporting requirements. The methodologies, sampling techniques, sampling frequency, and the quality assurance/quality control procedures that have been implemented for each environmental activity are also detailed.

05 NUCLEAR FUELS

0504 Feed Processing

10956 **(RFP-Trans—441) Apparatus for denitration of uranyl nitrate and/or plutonium nitrate.** Tanaka, Akira; Onoshita, Toshio; Tanaka, Katsuyuki. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). Nov 1984. Contract AC04-76DP03533. Translation of Japanese Patent No. 58-49627 (1983). 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005305.

Apparatus is claimed for denitration of uranyl nitrate and/or plutonium nitrate that uses a fluidized bed equipped with an atomizing nozzle for thermal decomposition and denitration of uranyl nitrate and/or plutonium nitrate to produce uranium trioxide and/or plutonium dioxide. The apparatus is characterized by a structure in which the diameter of the apparatus decreases in more than one step from the point at which the atomizing nozzle is attached toward the straightening vanes in the lower part of the fluidized bed.

0506 By-products

REFER ALSO TO CITATION(S) 05060010986

10957 **(RFP—3652) Americium-241: the most useful isotope of the actinide elements.** Navratil, J.D. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 1984. Contract AC04-76DP03533. 8p. (CONF-8404218—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005176.

From Americium Chemical Society meeting; Denver, CO, USA (19 Apr 1984).

Used extensively in nuclear gauges and in many other areas, this man-made element (Atomic Number 95) was first isolated in weighable amounts during World War II. Americium is now a very useful by-product of the nuclear industry and is produced in kilogram amounts by appropriate recovery, separation and purification processes. A review will be presented of its discovery, nuclear and chemical properties, and uses, with emphasis on its production process and separations chemistry.

0507 Fuels Production And Properties

REFER ALSO TO CITATION(S) 05070011078, 11079, 11080, 11085, 11099, 11101, 11126

10958 (KFK—3777, pp 61-71) **Quality assurance and quality control requirements in nuclear fuel procurement in Finland.** Ojanen, M. Jul 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85750267. (CONF-840326—).

From Seminar on practical experience in the application of quality control in water reactor fuel fabrication; Karlsruhe, F.R. Germany (12 Mar 1984).

The paper gives a description of the general procedures and requirements set by the Finnish safety authorities for nuclear fuel procurement and it also discusses the different organizations involved. The contents of separate guides for the supervision of fuel design and manufacture as well as nuclear fuel quality assurance are discussed in more detail. Finally the operating experience of fuel in Finnish nuclear power plants is briefly described.

10959 (KFK—3777, pp 85-96) **Fuel manufacturing follow at FRAGEMA.** Pancaccini, G. Jul 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85750267. (CONF-840326—).

From Seminar on practical experience in the application of quality control in water reactor fuel fabrication; Karlsruhe, F.R. Germany (12 Mar 1984).

Fragema has set up a complete surveillance system totally independant of the one performed by manufacturers. This paper exposes that system and the specific responsabilities of each party: subcontractors, manufacturers, Fragema, customers. The Fragema involvment is presented throughout the fabrications starting with the subcontractors until the final release and shipment. The data collection system which also allows feedbacks between design, manufacturing and reactor operation is briefly described.

10960 (KFK—3777, pp 235-248) **Technical and administrative implementation of QA and QC during fabrication of additivated and barrier fuel pellets.** Coppola, C.; Valle, P. Jul 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85750267. (CONF-840326—).

From Seminar on practical experience in the application of quality control in water reactor fuel fabrication; Karlsruhe, F.R. Germany (12 Mar 1984).

The importance of the project requires the responsibility to implement QA and QC activities in order to achieve the maximum data and avoid any possible mix-up. The great number of fuel composition, the small size of fuel batches, the necessity to utilize "Qualification during fabrication" procedures, were the main aspects to take in account. Major conditions adverse to quality or manufacturing losses, were identified, and corrective action taken. The experimental characteristics of certain process to undetermined status of the quality and special kinds of control were requested in order to determine if the process parameters could be safely applied.

10961 (KFK—3777, pp 277-283) **Quality assurance in the fabrication of natural uranium nuclear fuels.** Koll, J.H. Jul 1984. (In Spanish). NTIS (US Sales Only), PC A24/MF A01. File Number DE85750267. (CONF-840326—).

From Seminar on practical experience in the application of quality control in water reactor fuel fabrication; Karlsruhe, F.R. Germany (12 Mar 1984).

The experience obtained through seven years of development and fabrication of nuclear fuel, has shown that it is possible to implemented a quality assurance system stepwise. The most important factor is adequately trained personell, at all levels, which has had the opportunity to work at the actual industrial equipment during the development phase. Experienced laboratories for testing the quality of materials, products and for the qualification of the process, is another vital factor.

10962 (KFK—3777, pp 305-331) **Physical methods of quality control of fuel pellets.** Vollath, D.; Wachtendonk, H.J. von. Jul 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85750267. (CONF-840326—).

From Seminar on practical experience in the application of quality control in water reactor fuel fabrication; Karlsruhe, F.R. Germany (12 Mar 1984).

To guarantee a uniform quality of the final product, it is indispensable that, beginning with the powder, all intermediate products are subject to control. In this paper control methods are presented both for methods of quality control and methods of characterization. Since a complete description of all possible methods goes beyond the framework of this contribution only some methods are presented by a way of example.

0508 Spent Fuels Reprocessing

10963 **(CONF-841105—58) Calculated k-effectives for plutonium critical experiments. Consolidated Fuel Reprocessing Program.** Easter, M.E.; Dodds, H.L.; Primm, R.T. III. (Tennessee Univ., Knoxville (USA); Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005378.

From Joint meeting of the American Nuclear Society and the Atomic Industrial Forum; Washington, DC, USA (11 Nov 1984).

Design criteria for a reprocessing facility for Liquid Metal Fast Breeder Reactor fuel are presently being developed. One major issue of concern is the criticality safety of all equipment (dissolver, centrifuge, holding tanks, etc.) that is used to contain the plutonium solution. The purpose of this work is to evaluate the validity of the SCALE code system for application to plutonium systems when used with cross section data from the 27-group ENDF/B-IV and 16-group Hansen-Roach libraries (available in SCALE). Previous work has been done in this area, but it was limited to one-dimensional discrete ordinates calculations. Twelve sets of critical plutonium experiments yielding a total of thirty-eight computational models are considered. The experiments were performed in spherical, cylindrical, and slab geometries covering a wide range of fuel composition. The hydrogen-to-plutonium atom ratio varied from 3695 for an infinite dilute system to 0.04 for damp, plutonium oxide polystyrene experiments. The SCALE system employs several codes for criticality calculations, but only two are used in this work. Criticality Safety Analysis Sequence Number 1 (CSAS1) uses discrete ordinates theory to calculate k-eff, and its application is limited to one-dimensional calculations. Criticality Safety Analysis Sequence Number 2 (CSAS2) uses Monte Carlo methods to calculate k-eff, and its application includes three dimensional systems. Calculated results of the 38 models using both cross sections libraries are presented. The calculated k-effectives vary from a high of 1.04119 +- 4.87E-3 to a low of 0.99458 +- 4.66E-3. The majority of the k-effectives vary between 1.01 and 1.03 illustrating a systematic overestimation of k-eff. Some of the one dimensional experiments were modeled with both CSAS1 and CSAS2 to see if the

calculated k-effectives show any significant dependency on the code used.

10964 **(CONF-841201—26) Performance characteristics of axisymmetric venturi-like reverse-flow diverters. Consolidated Fuel Reprocessing Program.** Smith, G.V.; Counce, R.M. (Tennessee Univ., Knoxville (USA). Dept. of Mechanical and Aerospace Engineering; Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 28p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85005276.

From ASME winter annual meeting; New Orleans, LA, USA (9 Dec 1984).

This paper presents experimental and model-predicted pressure-flow characteristics of axisymmetric venturi-like reverse-flow diverters (RFDs), the key component of fluid pumping systems utilized for the transport of hazardous fluids. The effects of several key geometric parameters, operating conditions, and fluid properties on the performance of the RFD are presented and compared to model predictions. The results indicate good agreement between data and theory over a large portion of the range of variables studied. Cavitation is observed to be the primary factor in limiting the performance of the RFD at small values of load impedances.

10965 **(UNI-SA—138) Segregation of spent N-Reactor fuel by plutonium isotopic content.** Dowell, J.L. (UNC Nuclear Industries, Inc., Richland, WA (USA)). 16 Oct 1984. Contract AC06-76RL01857. 13p. (CONF-8410209—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85004550.

From Safeguards symposium; Richland, WA, USA (18 Oct 1984).

This presentation covers the effort at UNC Nuclear Industries to sort spent fuel by plutonium isotopic content. The background design goals and equipment are briefly covered. The instrumentation, calibration and background problems are covered in greater depth.

0509 Transport And Storage

REFER ALSO TO CITATION(S) 05090010968, 11486

10966 **(SAND—83-2505) Breeder Spent Fuel Handling (BSFH) cask study for FY83. Final report.** Diggs, J.M. (Sandia National Labs., Albuquerque, NM (USA)). Jan 1985. Contract AC04-76DP00789. 33p. (TTC—0461). NTIS, PC A03. File Number DE85004931.

This report documents a study conducted to investigate the applicability of existing LWR casks to shipment of long-cooled LMFBR fuel from the Clinch River Breeder Reactor Plant (CRBRP) to the Breeder Reprocessing Engineering Test (BRET) Facility. This study considered a base case of physical constraints of plants and casks, handling capabilities of plants, through-put requirements, shielding requirements due to transportation regulation, and heat transfer capabilities of the cask designs. Each cask design was measured relative to the base case. 15 references, 4 figures, 6 tables.

0520 Waste Management

REFER ALSO TO CITATION(S) 05200010997, 10998, 10999, 11000, 11001, 11002, 11003, 11205, 11345, 11410, 11621, 11625, 11665, 11723

10967 **(BMI/ONWI—529) Measured data from the Avery Island Site C heater test.** Waldman, H.; Stickney, R.G. (RE/SPEC, Inc., Rapid City, SD (USA)). Nov 1984. Contract AC02-83CH10140. 85p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85006318.

Over the past six years, a comprehensive field testing program was conducted in the Avery Island salt mine. Three single canister heater tests were included in the testing program. Specifically, electric heaters, which simulate canisters of heat-generating nuclear waste, were placed in the floor of the Avery Island salt mine, and measurements were made of the response of the salt to heating. These tests were in operation by June 1978. One of the three heater tests, Site C, operated for a period of 1858 days and was decommissioned during July and August 1983. This data report presents the temperature and displacement data gathered during the operation and decommissioning of the Site C heater test. The purpose of this data report is to transmit the data to the scientific community. Rigorous analysis and interpretation of the data are considered beyond the scope of a data report. 6 references, 21 figures, 1 table.

10968 **(DOE/NV/10250—17) Commercial Nuclear Waste Research and Development Program. Annual report, fiscal year 1984.** (Westinghouse Electric Corp., Mercury, NV (USA). Waste Technology Services Div.). Jan 1985. Contract AC08-82NV10250. 50p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85005635.

This document is a report of fiscal year 1984 activities performed to meet task objectives of the Nevada Nuclear Waste Storage Investigations (NNWSI) Project Plan. Noteworthy accomplishments were: operation of a fuel temperature test which evaluates fuel performance in an environment expected for metal cask storage. This test is being performed for the DOE Richland Operations Dry Storage Fuel Integrity Demonstration Program; characterization of fuel assemblies and storage canisters, which includes fuel assembly visual inspection, videotape and still photography, and contamination swipe sampling; and canister gas and full volume filtration sampling, contamination swipe sampling, and residue collection; removal of fuel assemblies from seal welded storage canisters, using the E-MAD canister cutter; integrity monitoring of fuel assemblies in seal welded canisters, by sampling and analysis of canister cover gas; and fuel assemblies in unwelded canisters, by collection and analysis of fuel surface contamination swipe samples and canister residue; emplacement/removal of canisterized fuel assemblies in the E-MAD drywells; and preparation of a summary storage history of all fuel assemblies at the E-MAD facility, including FY 1983 activities involving those fuel assemblies.

10969 **(DOE/OR—853) Characterization and assessment for the Weldon Spring Quarry low-level radioactive waste storage site.** (Berkeley Geosciences Associates, CA (USA)). Sep 1984. 471p. NTIS, PC A20/MF A01; 1; GPO Dep. File Number DE85005424.

The Weldon Spring Quarry is located approximately 4 miles from the Weldon Spring Chemical Plant and 20 miles west of St. Louis. Originally a limestone and sand quarry, the 9 acre site was later used for the disposal of TNT-contaminated soils during the 1940's and the disposal of low-level radioactive waste during the 1960's. The most important potential hazards posed by the quarry are contamination of groundwater, radiation exposure and contamination of trespassers, and contamination of surface waters. The potential for groundwater contamination was identified at an early date by the US Department of Energy (DOE) as the most important of these potential hazards. Particular concern exists for the future of the municipal well field located between the quarry and the Missouri River. At the present time the well field supplies drinking water for the area from Weldon Spring up to and including parts of the city of St. Charles. Chapters are devoted to geology, waste inventory, hydrology, investigations of radionuclide migration from the quarry, numerical modeling of engineering options, and raffinate pits. 40 references, 182 figures, 49 tables, 7 appendixes.

10970 **(DOE/OR/20722—3) Environmental monitoring report, 1980, 1981, 1982 for the former Middlesex Sampling Plant and Middlesex Municipal Landfill Sites.** (Bechtel National, Inc., Oak Ridge, TN (USA). Advanced Technology Div.). Oct 1984. Contract AC05-81OR20722. 79p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85004928.

During periods of remedial action activities conducted in 1980 and 1981 at designated sites in the Borough of Middlesex, New Jersey, air, water, and sediments were sampled and analyzed to verify the adequacy of contamination control and compliance with applicable standards. Analytical results show that remedial action activities at the Middlesex Sampling Plant (MSP) and vicinity properties were conducted, with few exceptions, within applicable standards. During 1982, a surveillance monitoring program was initiated at the MSP and at the former Middlesex Municipal Land-

fill (MML) site. Radioactivity was measured in air and water to allow calculation of radiation doses to the public. The resulting dose from external gamma radiation at the MSP site boundary in 1982 was approximately twice natural background and less than 40% (background included) of the Department of Energy (DOE) standard. The highest continuous occupancy dose to the bronchial epithelium (lungs) from radon exposure at the MML boundary was approximately twice the background value or about 60% (background included) of the DOE standard. 12 references, 15 figures, 28 tables.

10971 **(DOE/OR/20722—17) Environmental monitoring report for the former Middlesex Sampling Plant and Middlesex Municipal Landfill Sites, calendar year 1983.** (Bechtel National, Inc., Oak Ridge, TN (USA). Advanced Technology Div.). Oct 1984. Contract AC05-81OR20722. 45p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85004932.

During 1983, an environmental monitoring program was continued at the former Middlesex Sampling Plant (MSP) and former Middlesex Municipal Landfill (MML) sites, located in the Borough of Middlesex, New Jersey. The sites are part of the Formerly Utilized Sites Remedial Action Program (FUSRAP), a United States Department of Energy (DOE) program to clean up or otherwise control sites where low-level radioactive contamination remains from the early years of the nation's atomic energy program. The monitoring program at the MSP and MML measures the uranium and radium concentrations in surface and groundwater, the radon concentrations in air, and external gamma exposure levels. Radiation doses to the public are also calculated. All environmental samples collected are analyzed to determine compliance with applicable environmental quality standards. DOE Order 5480.1A, Chapter XI, provides applicable Concentration Guide limits for radionuclides in controlled and uncontrolled areas. During 1983, average annual concentrations of uranium and radium-226 in groundwater and surface water within the controlled areas of both the MSP and MML were below the DOE CG for uncontrolled areas. Annual average radon levels in air at both the MSP and MML were below the CG for uncontrolled areas. External gamma monitoring in 1983 showed all monitoring locations at both sites reporting gamma exposure rates below DOE Radiation Protection Standards. All radiation doses to the public were within DOE standards. Results of the monitoring program during 1983 did not differ significantly from the results obtained during 1982. 8 references, 9 figures, 12 tables.

10972 **(DOE/TRU—8201) Long-Range Master Plan for Defense Transuranic Waste Management.** (USDOE Assistant Secretary for Defense Programs, Washington, DC). May 1984. 111p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85004302.

The Long-Range Master Plan for Defense Transuranic Waste Management is designed to serve as a framework for US Department of Energy (DOE) defense transuranic (TRU) waste management planning in the transition period from interim management to permanent disposal. It is an integrated plan, placing activities at the several sites on a common schedule with balanced total budget demands. It is a comprehensive plan, covering research and development, analysis, decisionmaking, facility design and construction, operations, and decommissioning for all aspects of TRU waste management. The Master plan documents goals and objectives, identifies major milestones, and identifies key decisions.

10973 **(HEDL—7455) Zircaloy cladding corrosion degradation in a Tuff repository: initial experimental plan.** Smith, H.D. (Hanford Engineering Development Lab., Richland, WA (USA)). Jul 1984. Contract AC06-76FF02170. 42p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85005717.

The projected environmental history of a Tuff repository sited in an unsaturated hydrologic setting is evaluated to identify the potentially most severe corrosion conditions for Zircaloy spent fuel cladding. Three distinct corrosion periods are identified over the projected history. In two of those, liquid water may be present which is believed to produce the most severe corrosive environment for Zircaloy spent fuel cladding. In the time interval 100 to 1000 years after emplacement in the repository, the most severe condition is exposure to 170°C water at about 100 psi in an unbreached canister. This condition will be reproduced experimentally in an autoclave. For times after 1000 years, the most severe condition is exposure to 90°C water that is equilibrated with the tuff and invades breached canisters. This condition will be reproduced with a water bath system.

10974 **(IS-T—1120) Studies of cation exchange for the isolation and concentration of trace level components of complex aqueous mixtures.** Kaczvinsky, J.R. Jr. (Ames Lab., IA (USA)). Dec 1984. Contract W-7405-ENG-82. 252p. NTIS, PC A12/MF A01; 1; GPO Dep. File Number DE85005612.

Trace level organic bases are concentrated from aqueous solution by cation exchange on a column of sulfonated macroreticular XAD-4 resin. Washing of the column with organic solvents removes neutrals and acids. Ammonia gas is introduced into the column prior to elution of the basic-organics with either methanol or ether containing ammonia. After solvent evaporation, the concentrated sample is analyzed by gas chromatography. Recoveries of over 85% are found with at least one of the eluents for over 50 bases tested at levels <1 ppM. Improved recoveries and reproducibility are seen over a simple ether extraction procedure. Samples of river water, shale oil process water, and supernatant from an agricultural chemical disposal pit are analyzed. Porous, bifunctional chelating resins are prepared by base-catalyzed polymerization of a phenol and iminodiacetic acid with an aldehyde. These resins are used to concentrae trace levels of cesium-137 and strontium-90 from simulated nuclear waste. Various phenols, aldehydes, and templates are tested. Several experimental parameters are examined to determine their effect on resin affinity. Reaction temperature is found to have a significant effect on resin affinity. Attempts to determine the structure of these resins are made using various analytical techniques, most notably photoacoustic spectroscopy. The affinity of these resins for other metals is examined, and they are found to sorb Cu^{2+}, Fe^{2+}, and Pb^{2+} effectively. Preliminary studies of functionalized poly(styrene-divinylbenzene)s, coated exchangers, and liquid ion exchangers as possible approaches to nuclear waste decontamination are performed. 26 references, 26 figures, 25 tables.

10975 **(ONWI—119-Vol.4) Gulf Coast Salt Domes geologic Area Characterization Report, North Louisiana Study Area. Volume IV. Technical report.** (Law Engineering Testing Co., Marietta, GA (USA)). Jul 1982. Contract AC06-76RL01830. 435p. NTIS, PC A19/MF A01; 1; GPO Dep. File Number DE85006480.

The Louisiana Geologic Area Characterization Report (ACR) is a compilation of data gathered during the Area Characterization phase of the Department of Energy's National Waste Terminal Storage program in salt. The characterization of Gulf Coast Salt Domes as a potential site for storage of nuclear waste is an ongoing process. This report summarizes investigations covering an area of approximately 2590 km^2 (1000 mi^2). Subsequent phases of the program will focus on smaller land areas and fewer specific salt domes, with progressively more detailed investigations, possibly culminating with a license application to the Nuclear Regulatory Commission. The data in this report are a result of drilling and sampling, geophysical and geologic field work, and intensive literature review. The ACR contains text discussing data usage, interpretations, results and conclusions based on available geologic and hydrologic data, and figures including diagrams showing data point locations, geologic and hydrologic maps, geologic cross sections and other geologic and hydrologic information. An appendix contains raw data gathered during this phase of the project and used in the preparation of these reports.

10976 **(ONWI—120-Vol.7) Gulf Coast Salt Domes geologic Area Characterization Report, Mississippi Study Area. Volume VII. Appendix.** (Law Engineering Testing Co., Marietta, GA (USA)). Jul 1982. Contract AC06-76RL01830. 573p. NTIS, PC A24/MF A01; 1; GPO Dep. File Number DE85006481.

This volume contains the following appendices: borings; sample analyses; ground water;surface geology; geophysics; microseismicity; and seismicity.

10977 **(ORNL/TM—9229) Site characterization of the West Chestnut Ridge site.** Ketelle, R.H.; Huff, D.D. (Oak Ridge National Lab., TN (USA)). Sep 1984. Contract AC05-84OR21400. 144p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE85001695.

This report summarizes the results of investigations performed to date on the West Chestnut Ridge Site, on the Department of Energy (DOE) Oak Ridge Reservation. The investigations performed include geomorphic observations, areal geologic mapping, surficial soil mapping, subsurface investigations, soil geochemical and mineralogical analyses, geohydrologic testing, groundwater fluctuation monitoring, and surface water discharge and precipitation monitoring. 33 references, 32 figures, 24 tables.

10978 **(ORNL/TM—9314) Geohydrologic characterization of proposed Solid Waste Storage Area (SWSA) 7.** Rothschild, E.R.; Huff, D.D.; Haase, C.S.; Clapp, R.B.; Spalding, B.P.; Farmer, C.D.; Farrow, N.D. (Oak Ridge National Lab., TN (USA)). Dec 1984. Contract AC05-84OR21400. 267p. NTIS, PC A12/MF A01; 1; GPO Dep. File Number DE85004956.

A critical flow flume and several temporary gaging stations were installed on the site to characterize the surface water system. The site is drained by a central stream that flows into Melton Branch. Two smaller tributaries are located on either side of the site. The site lies within the White Oak Creek watershed, thus drainage from the site is monitored by the established system for the drainage basin. A monitoring well network of 18 wells was installed on site to characterize the groundwater flow regime and to collect data on the aquifer properties. The aquifer underlying the site is relatively low in permeability (2.57×10^{-5} cm/sec), anisotropic, and flow is controlled by the secondary porosity formed by the pervasive jointing. The surrounding tributaries are the local discharge areas for the groundwater system, but, based on the water budget and the geologic investigations, it appears that part of the groundwater discharge may directly enter Melton Branch. Water samples collected from the wells and streams indicate that the site is uncontaminated by surrounding activities on the ORR. 47 references, 34 figures, 15 tables.

10979 **(PNL-SA—12174) Innovative electrical technique for in-place stabilization of contaminated soils.** Buelt, J.L.; FitzPatrick, V.F.; Timmerman, C.L. (Pacific Northwest Lab., Richland, WA (USA)). May 1984. Contract AC06-76RL01830. 23p. (CONF-840828—7). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000366.

From International synfuels policies and technologies symposium; Philadelphia, PA, USA (19 Aug 1984).

This paper discusses an emerging thermoelectric process known as in situ vitrification as a potential method for stabilizing buried waste inplace. The paper describes the Scott-Tee power system for the large-scale testing unit and how its design was developed. A brief synopsis of the performance assessments that have been conducted with regard to waste form quality, effect of soil conditions on processing, physical constraints of the process, and vitrification of soils containing organic and hazardous components is presented. A summary of an economic analysis is also provided.

10980 **(PNL-SA—12304) Reference and testing materials available from the Materials Characterization Center.** Daniel, J.L.; Barner, J.O.; Mellinger, G.B. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1984. Contract AC06-76RL01830. 10p. (CONF-841157—41). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004535.

From Symposium on the scientific basis for nuclear waste management; Boston, MA, USA (26 Nov 1984).

A major responsibility of the Materials Characterization Center (MCC) is to acquire and distribute reference and testing materials endorsed by DOE, for use in research and development in nuclear waste management. MCC standard materials provide a common basis for data obtained in waste repository development work, thereby assisting in developing a defensible data base of known accuracy and precision. Homogeneity of standard materials is of particular importance. MCC emphasizes homogeneity of composition and physical characteristics of the standard materials, using statistical methods in sampling procedures and evaluation of analytical data.

10981 **(PNL-SA—12314) Self-radiation damage in actinide host phases of nuclear waste forms.** Weber, W.J.; Wald, J.W.; Matzke, H. (Pacific Northwest Lab., Richland, WA (USA); Commission of the European Communities, Karlsruhe (Germany, F.R.). European Inst. for Transuranium Elements). Nov 1984. Contract AC06-76RL01830. 9p. (CONF-841157—42). NTIS, PC A02/MF A01; GPO Dep. File Number DE85004555.

From Symposium on the scientific basis for nuclear waste management; Boston, MA, USA (26 Nov 1984).

Three crystalline ceramic materials ($Ca_2Nd_8(SiO_4)_6O_2$, $Gd_2Ti_2O_7$, $CaZrTi_2O_7$), which occur as host phases for the long-lived actinides in many nuclear waste formulations, were doped with Cm-244, and the effects of self-radiation damage from alpha decay on microstructure and physical properties were investigated. The irradiation-induced microstructure consisted of individual amorphous tracks from both the alpha-recoil particles and the spontaneous fission fragments. The eventual overlap of the tracks at higher doses leads to a completely amorphous state. This radiation-induced amorphization process results in measured increases in volume, leachability, and stored energy. Thermal recovery of the radiation-induced swelling and amorphization occurs with full recrystallization to the initial structures.

10982 **(PNL-SA—12320) Purpose of the Materials Characterization Center.** Mendel, J.E. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1984. Contract AC06-76RL01830. 7p. (CONF-841157—40). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004557.

From Symposium on the scientific basis for nuclear waste management; Boston, MA, USA (26 Nov 1984).

The Materials Characterization Center (MCC) at the Pacific Northwest Laboratory is the experimental arm of the Materials Characterization Organization (MCO), which was established by the US Department of Energy (DOE) in FY 1980 to ensure high quality characterization and qualification of waste package materials essential to the reliable performance of DOE nuclear waste management programs. MCC is responsible for publishing key test methods and data in the Nuclear Waste Materials Handbook (DOE/TIC-11400). It sponsors a continuing series of workshops that address materials characterization test method issues. It supplies well-characterized reference and testing materials for use by the DOE nuclear waste management programs. It develops generic test methods and supports the repository waste package projects in developing selected site-specific test methods and performing confirmatory testing of these methods. When these test methods are approved by the MRB they constitute the formal tests to be used by laboratories to test and qualify materials, evaluate waste package components, and assure compliance with standards and/or specifications for the final product.

10983 **(PNL-SA—12355) Hydrothermal waste package interactions with methane-containing basalt groundwater.** McGrail, B.P. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1984. Contract AC06-76RL01830. 8p. (CONF-841157—55). NTIS, PC A02/MF A01; GPO Dep. File Number DE85005293.

From Symposium on the scientific basis for nuclear waste management; Boston, MA, USA (26 Nov 1984).

Hydrothermal waste package interaction tests with methane-containing synthetic basalt groundwater have shown that in the absence of gamma radiolysis, methane has little influence on the glass dissolution rate. Gamma radiolysis tests at fluxes of 5.5×10^5 and 4.4×10^4 R/hr showed that methane-saturated groundwater was more reducing than identical experiments where Ar was substituted for CH_4. Dissolved methane, therefore, may be beneficial to the waste package in limiting the solubility of redox sensitive radionuclides such a ^{99}Tc. Hydrocarbon polymers known to form under the irradiation conditions of these tests were not produced. The presence of the waste package constituents apparently inhibited the formation of the polymers, however, the mechanism which prevented their formation was not determined.

10984 **(PNL-SA—12360) Effects of radial temperature gradients on glass fracture in simulated high-level waste canisters.** Farnsworth, R.K.; Chan, M.K.W.; Slate, S.C. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1984. Contract AC06-76RL01830. 9p. (CONF-841157—54). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005291.

From Symposium on the scientific basis for nuclear waste management; Boston, MA, USA (26 Nov 1984).

The Pacific Northwest Laboratory performed experiments on canisters of simulated high-level waste (HLW) glass to estimate the effects of radial temperature gradients on the degree of glass fracture in actual HLW canisters. Glass cracking may result in an increased amount of fine glass particles that are of concern in transportation and repository safety analyses. A test matrix was developed to examine the effect of air cooling, water quenching, and internal fins on canister cooling rates, radial temperature gradients, glass cracking levels, and particle size distributions. The data show the reduction of radial temperature gradients to be important in reducing the amount of waste glass fracturing. Cracking profiles show that internal carbon steel fins significantly decrease the degree of fracture. Different cooling rates only affect the amount of particles above a certain size. The amount of particles below that size depends on the interaction between the glass and canister. 4 references, 5 figures, 1 table.

10985 **(PNL-SA—12393) Remote removal of contaminated equipment from a radiochemical engineering cell.** Scharnhorst, N.L.; Bryan, G.H.; Bjorklund, W.J. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1984. Contract AC06-76RL01830. 21p. (CONF-841105—50). NTIS, PC A02/MF A01; GPO Dep. File Number DE85004556.

From Joint meeting of the American Nuclear Society and the Atomic Industrial Forum; Washington, DC, USA (11 Nov 1984).

Safe remote removal of radioactively contaminated equipment was performed at the Pacific Northwest Laboratory (PNL) during the cleanout of a hot cell containing equipment used to demonstrate the vitrification of high level waste. The equipment had to be cut into pieces that could be packed into shielded boxes for disposal. Innovative adaptations were made to state-of-the-art cutting tools to make this safe handling and disposal possible within the physical restraints of a radioactive cell. 8 figures, 1 table.

10986 **(RFP—3704) Americium transfer studies using hollow fiber/extractant membranes.** Muscatello, A.C.; Navratil, J.D.; Killion, M.E. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 2 May 1984. Contract AC04-76DP03533. 12p. (CONF-8405265—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004973.

From 8. actinide separations workshop; Boulder, CO, USA (30 May 1984).

Americium can be removed from low acid/high nitrate feeds using hollow fiber membrane modules. Americium can be concentrated in the stripping solution. (Maximum observed concentration was a factor of 3.1). Accurel hollow fibers are less prone to leakage problems.

10987 **(RHO-PB-SR—10-B-WM-Nov.84) Defense waste and byproducts management monthly report, November 1984.** (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). 1984. Contract AC06-77RL01030. 96p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85004937.

Thirteen thousand three hundred ninety-two (13,392) gallons of radioactive liquid waste were pumped from single shell tank farms during the month of November. Two thousand thirty-two (2032) gallons were pumped from the BY tank farm saltwells and an additional 11,360 gallons were pumped from the catch tank systems being prepared for isolation. Approximately 30,500 gallons have been pumped from single shell tank farms FYTD. A total of 2.7 MCi of 41% strontium-90 material was purified and transferred to Cell 36 for simmering/holding while awaiting transfer to WESF for encapsulation. This material was one of the purest and highest grade of any yet produced for WESF feed. 242-A Evaporator Run 85-1 was completed November 14. Total throughput for the evaporator was approximately 1.7 million gallons in November; FYTD evaporator throughput is approximately 3.0 million gallons. Evaporator Run 85-2 is scheduled to start by mid-December. The Wright, Schuchart, Harbor (WSH) Company from Seattle, Washington was determined to be the low responsive bidder and has been awarded the Dry Material Receiving and Handling Facility (DMRHF) contract. The DMRHF is a portion of Project B-475, Transportable Grout Facility. Strontium encapsulation restarted November 20, and a record six process runs in one week was accomplished. Two product capsules and three waste capsules were completed this month. A total of two product capsules and six waste capsules have been completed fiscal year to date.

10988 **(RHO-PB-SR—10-B-WM-Oct.84) Defense waste and byproducts management monthly report, October 1984.** (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). 1984. Contract AC06-77RL01030. 96p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85004707.

Isolation work under Projects B-222 and B-231 continued. Tanks 101-TY, 103-TY, and 105-TY were declared Interim Isolated. TY Tank Farm is now the second of twelve Hanford 200 Area single-shell tank farms to have all tanks isolated. Subsequent to the unplanned replacement of the PB-2 pump and plugging of the EC-1 condensor at the 242-A Evaporator, Run 84-5 was completed October 21. Evaporator Run 85-1 was started on October 27 and is scheduled for completion in early November. Total throughput at the 242-A Evaporator was approximately 1.3 million gallons in October. Approximately 5400 gallons of interstitial liquid was pumped from BY Tank Farm saltwells. Jet pumping operations continued throughout the month in Tanks 108-BY, 110-BY and 111-BY. Tank 104-BY was placed in observation mode for evaluations to determine if it will meet the criteria for Interim Stabilization. During the recent caustic strike campaign, a process to demonstrate removal of barium from the strontium solution was implemented for the first time since strontium purification processing began in 1975. Using sodium sulfate, the barium was selectively precipitated from the strontium solution. This removed approximately 88% of the barium with only a 17.8% strontium loss. Removal of the barium enabled the caustic strike product solution to meet all encapsulation feed specifications, an accomplishment never before achieved. Surface stabilization of the S-19 Pond and S-10 ditch (4 acres total) was completed.

10989 **(SAND—84-0221) Geoengineering properties of potential repository units at Yucca Mountain, southern Nevada.** Tillerson, J.R.; Nimick, F.B. (eds.). (Sandia National Labs., Albuquerque, NM (USA)). Dec 1984. Contract AC04-76DP00789. 120p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85006135.

The Nevada Nuclear Waste Storage Investigations (NNWSI) Project is currently evaluating volcanic tuffs at the Yucca Mountain site, located on and adjacent to the Nevada Test Site, for possible use as a host rock for a radioactive waste repository. The behavior of tuff as an engineering material must be understood to design, license, construct, and operate a repository. Geoengineering evaluations and measurements are being made to develop confidence in both the analysis techniques for thermal, mechanical, and hydrothermal effects and the supporting data base of rock properties. The analysis techniques and the data base are currently used for repository design, waste package design, and performance assessment analyses. This report documents the data base of geoengineering properties used in the analyses that aided the selection of the waste emplacement horizon and in analyses synopsized in the Environmental Assessment Report prepared for the Yucca Mountain site. The strategy used for the development of the data base relies primarily on data obtained in laboratory tests that are then confirmed in field tests. Average thermal and mechanical properties (and their anticipated variations) are presented. Based upon these data, analyses completed to date, and previous excavation experience in tuff, it is anticipated that existing mining technology can be used to develop stable underground openings and that repository operations can be carried out safely.

10990 **(SAND—84-1444) Preliminary requirements for the emplacement and retrieval of defense high-level waste (DHLW) tests in the Waste Isolation Pilot Plant (WIPP).** Molecke, M.A.; Matalucci, R.V. (Sandia National Labs., Albuquerque, NM (USA)). Oct 1984. Contract AC04-76DP00789. 83p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85005499.

The requirements for emplacing and retrieving DHLW in the WIPP are summarized. Associated details are presented so that both the scientific intent and purposes for the test program can be defined and the parallel requirements of operational equipment designers are satisfied. The Actual DHLW Tests are divided into operational period, reference tests; containment period, accelerated aging tests; and long-term period, 1000-year-aged waste tests. Consistent with WIPP FEIS limitations, a maximum of 17.2 x 10^6 Ci will be used in these tests. Waste characteristics, tentative quantities, and test conditions are specified; details of associated instrumentation are also provided. The operational demonstrations for handling, emplacing, and retrieving DHLW in the WIPP are summarized. These demonstrations start with mock, nonradioactive canisters and conclude with actual, radioactive DHLW canisters. Test room considerations which can impact the operational demonstrations, such as room configuration and closure, and canister movement, are described. Hot cell design requirements mandated by the DHLW test and demonstration needs are listed. Finally, the tentative schedules of preliminary simulated DHLW technology experiments, operational demonstrations, and Actual DHLW Tests are provided.

10991 **(SAND—84-7211C) Application of far-field models to the disposal of nuclear waste in geologic formations.** Brandshaug, T.; Svalstad, D. (RE/SPEC, Inc., Rapid City, SD (USA)). Dec 1984. Contract AC04-76DP00789. 12p. (CONF-840854—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005489.

From Western States mining exposition; Reno, NV, USA (7 Aug 1984).

The particular issue discussed in this paper relates to far-field (FF) models, and their application to the study of geologic disposal of nuclear waste. Far-field models are utilized to provide information about rock behavior on a regional scale due to the presence of a repository. The far-field models describe the physical phenomena in terms of a mathematical boundary value problem. The model predicts details of these phenomena within a geometric boundary extending vertically down from the ground surface several thousand meters below the repository horizon, and laterally out several thousand meters beyond the edges of the repository. Techniques available to solve the FF boundary value problem include the finite difference method, the boundary element method, the finite element method, and closed form solutions. The FF models that are discussed utilize a closed form solution to solve the problem of conductive heat transfer associated with the heat produced by the radioactive waste at a decreasing rate, and the finite element method to predict the thermally induced displacements and associated stresses in the far-field rock. 9 references, 16 figures, 1 table.

10992 **(UCID—20301) Geologic structure mapping database Spent Fuel Test - Climax, Nevada Test Site.** Yow, J.L. Jr. (Lawrence Livermore National Lab., CA (USA)). 4 Dec 1984. Contract W-7405-ENG-48. 12p. NTIS, PC E02/MF A01; GPO Dep. File Number DE85006267.

Includes 2 sheets of 48x reduction microfiche.

Information on over 2500 discontinuities mapped at the SFT-C is contained in the geologic structure mapping database. Over 1800 of these features include complete descriptions of their orientations. This database is now available for use by other researchers. 6 references, 3 figures, 2 tables.

10993 **(WINCO—1028) Decontamination and decommissioning of CPP-603 BIF filter room. Final report.** Moser, C.L. (Westinghouse Idaho Nuclear Co., Inc., Idaho Falls (USA)). Dec 1984. Contract AC07-84ID12435. 33p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85004789.

This report describes the decontamination and decommissioning (D & D) of the Idaho Chemical Processing Plant (ICPP) BIF filter room. The ICPP is located at te Idaho National Engineering Laboratory (INEL). The BIF filter room is adjacent to the middle fuel storage basin of the CPP-603 building. The room became radioactively contaminated during its use as a filtering station for the fuel storage basins water supply. This report describes work performed to accomplish D & D objectives of reducing radiation and contamination problems. 2 references, 16 figures, 4 tables.

10994 **(PNL-tr—444) Description of the plant for solidification of fission products: PAMELA.** (Pacific Northwest Lab., Richland, WA (USA)). Dec 1984. Contract AC06-76RL01830. Translation source information not available . 57p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85005490.

The solidification of liquid high-level wastes from the reprocessing of nuclear fuels is at present the safe procedure for assuring the necessary long-term isolation from the biosphere of the radionuclides contained in those wastes. In particular, vitrification of the wastes guarantees a solid product which has long-term stability and which is suitable for ultimate storage in a geological formation. The foundation stone of the PAMELA plant for solidification of fission products was laid on 9 September 1981 at Mol in Belgium. This event represented an important step towards realization of the vitrification process developed as a joint German and Belgian effort and supported by the West German Federal Minister for Research and Technology. In 1985, this plant will for the first time in hot operation process high-level waste into glass blocks and glass beads - embedded in lead - at a production rate of 30 kg glass per hour. Thus an important objective of the ongoing German research and development in the field of fission-product vitrification will be achieved.

10995 **Lead-iron phosphate glass: a stable storage medium for high-level nuclear waste.** Sales, B.C.; Boatner, L.A. (Oak Ridge National Lab., TN). *Science (Washington, D.C.);* **226**: 45-48(5 Oct 1984). Contract W-7405-ENG-26.

Results are presented which show that lead-iron phosphate glasses are a promising new waste form for the safe immobilization of both high-level defense and high-level commercial radioactive waste. Relative to the borosilicate nuclear waste glasses that are currently the "reference" waste form for the long-term disposal of nuclear waste, lead-iron phosphate glasses have several distinct advantages: (1) an aqueous corrosion rate that is about 1000 times lower, (2) a processing temperature that is 100° to 250°C lower and, (3) a much lower melt viscosity in the temperature range from 800° to 1000°C. Most significantly, the lead-iron phosphate waste form can be processed using a technology similar to that developed for borosilicate nuclear waste glasses.

10996 **Permeability changes during time-dependent deformation of silicate rock.** Kranz, R.L.; Blacic, J.D. (Geophysics Group, Los Alamos National Laboratory, Los Alamos, New Alamos, New Mexico). *Geophysical Research Letters;* **11**: No. 10, 975-978(Oct 1984).

Permeability was measured during creep deformation of a tight sandstone and a granite at upper crustal conditions. With water at 100°C as the pore fluid, permeability first decreased then increased during loading to peak stress. Thereafer, permeability decreased as much as 50% over time, even though sample volumetric strain indicated continuous dilatant creep. A silica-rich precipitate was found at the ends of the specimens and etch pits found on quartz grain surfaces. From these observations, we infer that permeability changes during creep are a result of the competing processes of dissolution, precipitation and dilatant microcracking. Depending upon deformation rates, this could have ramifications which are beneficial for waste isolation, but deleterious for geothermal energy extraction schemes.

0530 Environmental Aspects

REFER ALSO TO CITATION(S) 05300010969

10997 **(BMI/ONWI—524) Ogallala Aquifer Mapping Program.** (Stone and Webster Engineering Corp., New York (USA)). Oct 1984. Contract AC02-83CH10140. 88p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85005639.

A computerized data file has been established which can be used efficiently by the contour-plotting program SURFACE II to produce maps of the Ogallala aquifer in 17 counties of the Texas Panhandle. The data collected have been evaluated and compiled into three sets, from which SURFACE II can generate maps of well control, aquifer thickness, saturated thickness, water level, and the difference between virgin (pre-1942) and recent (1979 to 1981) water levels. 29 figures, 1 table.

10998 **(CONF-841245—1) Influence of basalt/groundwater interactions on radionuclide migration.** Vandegrift, G.F. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 11p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85006226.

From Geochemistry of radionuclides migration; Argonne, IL, USA (3 Dec 1984).

The work presented here is a partial summary of the experimental results obtained in the Laboratory Analog Program. Two aspects of this effort are (1) the interaction between simulated basaltic groundwater and basalt fissures that were either freshly cleaved or laboratory altered by hydrothermal treatment with the simulated groundwater and (2) the effect of this interaction on radionuclide migration through these basalt fissures. The following conclusions of this study bear heavily on the predicted safety of a basalt repository: Sorption properties of freshly fissured basalt and naturally aged basalt are quite different for different chemical species. Analog experiments predict that aged basalt would be an effective retarder of cesium, but would be much less so for actinide elements. Distribution ratios measured from batch experiments with finely ground rock samples (presenting unaltered rock surfaces) are not a reliable means of predicting radionuclide migration in geological repositories. As the near-repository area is resaturated by groundwater, its ability to retard actinide migration will be degraded with time. Disturbing the natural flow of groundwater through the repository area by constructing and backfilling the repository will modify the composition of groundwater. This modified groundwater is likely to interact with and to modify naturally aged basalt surfaces downstream from the repository.

10999 **(DP—1694) Strontium sorption on Savannah River Plant soils.** Hoeffner, S.L. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Dec 1984. Contract AC09-76SR00001. 24p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005638.

A laboratory study of strontium-85 sorption was conducted using Savannah River Plant soil and groundwater from the low-level waste burial ground. Systematic variation of soil and water composition indicates that strontium sorption is most strongly a function of pH. Changes in clay content and in K^+, Ca^{2+}, or Mg^{2+} concentrations influence strontium sorption indirectly through the slight pH changes which result. The ions Na^+, Cl^-, and NO_3^- have no effect. Ferrous ion, added to groundwater to simulate the conditions of water at the bottom of waste trenches, did not account for low strontium sorption observed with some trench waters.

11000 **(LA—10188-MS) Groundwater chemistry along flow paths between a proposed repository site and the accessible environment.** Ogard, A.E.; Kerrisk, J.F. (Los Alamos National Lab., NM (USA)). Nov 1984. Contract W-7405-ENG-36. 49p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85005598.

The Nevada Nuclear Waste Storage Investigations Program of the Department of Energy is investigating Yucca Mountain in the Nevada Test Site as a possible repository location. As part of this investigation, the groundwater from all pumped wells in and near the site has been sampled and analyzed; the results are reported in this document. The speciation and solubility of nuclear waste elements in these groundwaters have been calculated using the EQ3/6 computer code. Estimates have also been made of the pH and Eh buffering capacity of the water/rock system of Yucca Mountain.

11001 **(NUREG/CR—3851-Vol.2) Progress in evaluation of radionuclide geochemical information developed by DOE high-level nuclear waste repository site projects. Report for January-March 1984.** Kelmers, A.D.; Kessler, J.H.; Arnold, W.D.; Meyer, R.E.; Cutshall, N.H.; Jacobs, G.K.; Lee, S.Y.; Clark, R.J. (Oak Ridge National Lab., TN (USA)). Oct 1984. Contract AC05-84OR21400. 58p. (ORNL/TM—9191-Vol.2). NTIS, PC A04/MF A01 - GPO. File Number TI85001477.

Geochemical information relevant to the retention of radionuclides by Department of Energy (DOE) candidate high-level waste repositories is being investigated by Oak Ridge National Laboratory (ORNL) for the Nuclear regulatory Commission (NRC). The project has evaluated values that have been reported by the Basalt Waste Isolation Project (BWIP) and the methodologies used to develop those values. Neptunium(V) sorption was dependent upon the basalt flow used in the test. Increasing the test temperature from 24 to 60°C increased the neptunium sorption ratio. Hydrazine did not reduce neptunium(V) to neptunium(IV) in solution. The Amicon filters used to separate the basalt and groundwater after contact have been shown to adsorb a low but significant fraction of the neptunium(V) in solution. Technetium(VII) removal by basalt from groundwater solutions was shown to be independent of the contact methodology but was quite sensitive to the solution composition. Sorption of uranium(VI) by basalt has yielded sorption ratio values higher than those reported by BWIP. Column chromatographic experiments have confirmed the technetium(VII) sorption ratio of ~ 0 L/kg. The McCoy Canyon basalt used in this experimental work was mineralogically characterized. Six phases were identified: plagioclase, mesostasis, pyroxene, magnetite, apatite, and pyrite. Geochemical modeling with PHREEQE and MINTEQ checked the calculated solubilities of 16 radionuclides reported by BWIP; the agreement was generally excellent.

11002 **(ORNL/TM—9231) Radionuclide migration pathways analysis for the Oak Ridge Central Waste Disposal Facility on the West Chestnut Ridge site.** Pin, F.G.; Witherspoon, J.P.; Lee, D.W.; Cannon, J.B.; Ketelle, R.H. (Oak Ridge National Lab., TN (USA)). Oct 1984. Contract AC05-84OR21400. 161p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85001499.

A dose-to-man pathways analysis is performed for disposal of low-level radioactive waste at the Central Waste Disposal Facility on the West Chestnut Ridge Site. Both shallow land burial (trench) and aboveground (tumulus) disposal methods are considered. The waste volumes, characteristics, and radionuclide concentrations are those of waste streams anticipated from the Oak Ridge National Laboratory, the Y-12 Plant, and the Oak Ridge Gaseous Diffusion Plant. The site capacity for the waste streams is determined on the basis of the pathways analysis. The exposure pathways examined include (1) migration and transport of leachate from the waste disposal units to the Clinch River (via the groundwater medium for trench disposal and Ish Creek for tumulus disposal) and (2) those potentially associated with inadvertent intrusion following a 100-year period of institutional control: an individual resides on the site, inhales suspended particles of contaminated dust, ingests vegetables grown on the plot, consumes contaminated water from either an on-site well or from a nearby surface stream, and receives direct exposure from the contaminated soil. It is found that either disposal method would provide effective containment and isolation for the anticipated waste inventory. However, the proposed trench disposal method would provide more effective containment than tumuli because of sorption of some radionuclides in the soil. Persons outside the site boundary would receive radiation doses well below regulatory limits if they were to ingest water from the Clinch River. An inadvertent intruder could receive doses that approach regulatory limits; however, the likelihood of such intrusions and subsequent exposures is remote. 33 references, 31 figures, 28 tables.

0540 Health And Safety

REFER ALSO TO CITATION(S) 05400011612

11003 **(ORNL—6097) Geochemical information for sites contaminated with low-level radioactive wastes: II. St. Louis Airport Storage Site.** Seeley, F.G.; Kelmers, A.D. (Oak Ridge National Lab., TN (USA)). Jan 1985. Contract AC05-84OR21400. 61p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85004955.

The St. Louis Airport Storage Site (SLASS) became radioactively contaminated as a result of wastes that were being stored from operations to recover uranium from pitchblende ores in the 1940s and 1950s. The US Department of Energy is considering various remedial action options for the SLASS under the Formerly Utilized Site Remedial Action Program (FUSRAP). This report describes the results of geochemical investigations, carried out to support the FUSRAP activities and to aid in quantifying various remedial action options. Soil and groundwater samples from the site were characterized, and sorption ratios for uranium and radium and apparent concentration limit values for uranium were measured in soil/groundwater systems by batch contact methodology. The uranium and radium concentrations in soil samples were significantly above background near the old contaminated surface horizon (now at the 0.3⁻ to 0.9⁻m depth); the maximum values were 1566 μg/g and 101 pCi/g, respectively. Below about the 6⁻m depth, the concentrations appeared to be typical of those naturally present in soils of this area (3.8 +- 1.2 μg/g and 3.1 +- 0.6 pCi/g). Uranium sorption ratios showed stratigraphic trends but were generally moderate to high (100 to 1000 L/kg). The sorption isotherm suggested an apparent uranium concentration limit of about 200 mg/L. This relatively high solubility can probably be correlated with the carbonate content of the soil/groundwater systems. The lower sorption ratio values obtained from the sorption isotherm may have resulted from changes in the experimental procedure or the groundwater used. The SLASS appears to exhibit generally favorable behavior for the retardation of uranium solubilized from waste in the site. Parametric tests were conducted to estimate the sensitivity of uranium sorption and solubility to the pH and carbonate content of the system.

0550 Regulations

11004 **(BNL—35510) Bar code instrumentation for nuclear safeguards.** Bieber, A.M. Jr. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 7p. (CONF-8411135—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004704.

From Institute of Nuclear Materials Management regional meeting; Oak Ridge, TN, USA (8 Nov 1984).

This paper presents a brief overview of the basic principles of bar codes and the equipment used to make and to read bar code labels, and a summary of some of the more important factors that need to be considered in integrating bar codes into an information system.

11005 (KFK—3777, pp 333-351) **Determination of the U-235-content in UF_6 within the shipment container.** Wachtendonk, H.J. von; Baumann, R. Jul 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85750267. (CONF-840326—).

From Seminar on practical experience in the application of quality control in water reactor fuel fabrication; Karlsruhe, F.R. Germany (12 Mar 1984).

RBU controls all received UF_6-cylinders for the U-235-content by means of a direct measurement, through the steelwall of the shipment container. This measurement is now performed for about two years in routine practice. More than 400 UF_6-containers have been measured up to now. The results of these measurements and the obtained precision are presented in this paper.

11006 **(LA—10135-C) International training course on implementation of state systems of accounting for and control of nuclear materials: proceedings.** (Los Alamos National Lab., NM (USA); Exxon Nuclear Co., Inc., Richland, WA (USA)). Jun 1984. Contract W-7405-ENG-36. 740p. (CONF-8310345—). NTIS, PC A99/MF A01; 1; GPO Dep. File Number DE85004636.

From 4. international training course on implementation of state sysytems of accounting for the control of nuclear materials (SSAC); Santa Fe, NM, USA (17 Oct 1983).

This report incorporates all lectures and presentations at the International Training Course on Implementation of State Systems of Accounting for and Control of Nuclear Materials held October 17 through November 4, 1983, at Santa Fe and Los Alamos, New Mexico and Richland, Washington, USA. Authorized by the US Nuclear Non-Proliferation Act and sponsored by the US Department of Energy in cooperation with the International Atomic Energy Agency, the course was developed to provide practical training in the design, implementation, and operation of a State system of nuclear materials accountability and control that satisfies both national and international safeguards requirements. Major emphasis for the 1983 course was placed on safeguards methods used at bulk-handling facilities, particularly low-enriched uranium conversion and fuel fabrication plants. The course was conducted by the University of California's Los Alamos National Laboratory and Exxon Nuclear Company, Inc. Tours and demonstrations were arranged at the Los Alamos National Laboratory, Los Alamos, New Mexico, and the Exxon Nuclear fuel fabrication plant, the Battelle Pacific Northwest Laboratory, Westinghouse Fast Flux Test Facility Visitor Center, and Washington Public Power System nuclear reactor facilities in Richland, Washington. Individual presentations were indexed for inclusion in the Energy Data Base.

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

0701 Physical Isotope Separation

11007 **Effect of neutralization on protectiveness of sulfide films on carbon steel.** Tapping, R.L.; Lavoie, P.A.; Davidson, R.D. (Atomic Energy of Canada, Ltd., Chalk River, Ontario). *Materials Performance;* **22**: No. 9, 43-47(Sep 1983).

During shutdown of the Girdler sulfide (GS) process heavy water plants, the carbon steel and stainless steel surfaces are neutralized with ammonia and/or sodium carbonate. The effects of neutralization on the protective pyrite film and subsequent in-plant corrosion rates were investigated. It was concluded that these neutralization methods did not destroy the protectiveness of the pyrite films.

0702 Radiation Sources

REFER ALSO TO CITATION(S) 07020011539

11008 **(SAND—84-0185) Beneficial uses of nuclear by-products/Sewage Sludge Irradiation Project. Progress report, January-June 1983.** (Sandia National Labs., Albuquerque, NM (USA)). Dec 1984. Contract AC04-76DP00789. 61p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85006455.

Sandia technical and engineering support for DOE's Byproduct Utilization Program (BUP) continued. A purchase order was placed for a prototype sludge solar dryer with Intermountain Wholesale, Inc. (IMCO) of Denver, Colorado. Gamma irradiation of various commodities in the Sandia Irradiator for Dried Sewage Solids (SIDSS) and in the Gamma Irradiation Facility (GIF) continued. Several tons of sludge were irradiated for a sludge stockpile experiment, and 2 tons of sludge have been irradiated for the NMSU Department of Crop and Soil Sciences. SIDSS upgrading has included the installation of new limit switches, vacuum pumps, speed controls, and elapsed time indicators. Routine and preventive maintenance has included swipe tests and lubrication of the conveyor bearings. A sludge stockpile experiment was initiated. All micro-

biological analyses are being done by the NMSU Department of Biology, and temperature measurements and sample handling and shipping are being done by SNLA. Sewage Solids Irradiation Transport System (SSITS) cask activities included placement of a contract for final machining of the two cask bodies. Analyses of cask performance when loaded with six strontium-90 (Sr-90) capsules were done.

11009 **(SAND—84-0797) Byproducts Utilization Program: Sewage Sludge Irradiation Project. Progress report, July-December 1983.** (Sandia National Labs., Albuquerque, NM (USA)). Dec 1984. Contract AC04-76DP00789. 33p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85006457.

Engineering support for a demonstration-scale irradiator design included assisting the City of Albuquerque in preparing a comprehensive site plan for their proposed sludge handling and treatment facilities. The solar sludge dryer has been delivered to SNLA. A preliminary sludge drying experiment indicated the importance of optimizing stirring and air flow. Installation of instrumentation and mechanical equipment continued. The Sandia Irradiator for Dried Sewage Solids (SIDSS) was used to irradiate 23 tons of dried, digested sewage sludge for the New Mexico State University (NMSU) Department of Crop and Soil Sciences. Gamma Irradiation Facility (GIF) operations included irradiation of ground pork for Toxoplasma gondii inactivation experiments, irradiation of surgical supplies and soil samples. Beneficial Uses Shipping Systems (BUSS) cask activities included near completion of the two full-scale cask bodies. Work continued on the Cask Safety Analysis Report (SAR) including additional analyses to reconfigure the six strontium fluoride capsules and/or reduce the number of capsules accommodated. NMSU has indicated no regrowth of salmonellae occurred in the irradiated sludge stockpile, while salmonellae did regrow in the unirradiated stockpile. Analyses of raw and digested sewage sludge from the Albuquerque Waste Water Treatment Plant showed levels of Yersinia enterocolitica (a human pathogen of emerging significance) to be below detection limits.

08 HYDROGEN

0801 Production

REFER ALSO TO CITATION(S) 08010011010, 11010, 11010

0804 Marketing And Economics

11010 **(ANL/CNSV—46) Economics of hydrogen production.** Gaines, L.L.; Wolsky, A.M. (Argonne National Lab., IL (USA)). Jan 1984. Contract W-31-109-ENG-38. 57p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85006492.

Much of the current interest in hydrogen (H_2) centers around its potential to displace oil and gas as a fuel. The results of this study should be useful to research and development managers making funding decisions, and they should also be of interest to energy analysts, economists, and proponents of a hydrogen economy. We examined the current costs of H_2 produced by commercially available technologies (from fossil fuels and by electrolysis) and projected these costs to 2010, to set cost goals for H_2 produced via new technologies. We also examined the sensitivity of H_2 costs to varying energy price forecasts, capital costs and the required rate of return on investment, and by-product credits. We find that conventionally produced H_2 will not break into the fuel market before 2010. 23 references, 19 figures, 12 tables.

0806 Industrial And Commercial Use

REFER ALSO TO CITATION(S) 08060011280

0808 Properties

REFER ALSO TO CITATION(S) 08080011453

09 OTHER SYNTHETIC AND NATURAL FUELS

0901 Hydrocarbon Fuels

REFER ALSO TO CITATION(S) 09010011178

11011 **(ANL/CNSV-TM—124) Energy from municipal waste: assessment of energy conservation and recovery in municipal wastewater treatment.** Pierson, F.W.; Pearson, C.V. (Argonne National Lab., IL (USA)). Oct 1984. Contract W-31-109-ENG-38. 124p. NTIS, PC A06/MF A01; GPO Dep. File Number DE85004826.

This document provides a qualitative report on the status of a program for energy conservation in wastewater treatment. Analyzing the nation's energy requirements for wastewater treatment by process has shown that the wastewater- and sludge-stabilization processes accounted for more than 56% of the energy used for wastewater treatment in 1978. Advanced processes are projected to have the largest increase in energy of all treatment processes between 1978 and the year 2000. To promote energy conservation in wastewater treatment, DOE has sponsored a number of projects (either wholly or in part), including the following: demonstration of the anaerobic upflow (ANFLOW) bioreactor at Knoxville, Tenn.; assessment of digester-gas production and use in anaerobic-digestion facilities; study of the enhancement of anaerobic digestion by carbon addition; demonstration of water-hyacinth wastewater-treatment (WHWT) at Lake Buena Vista, Florida; and demonstration of unheated anaerobic contact stabilization (UACS) of sludge. These programs are described. 19 references, 22 figures, 29 tables.

11012 **(CONF-841194—1) Biogasification products of water hyacinth wastewater reclamation.** Chynoweth, D.P.; Biljetina, R.; Srivastava, V.J.; Hayes, T.D. (Institute of Gas Technology, Chicago, IL (USA); Gas Research Inst., Chicago, IL (USA)). 1984. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005068.

From Southeast industrial biomass energy exposition; Atlanta, GA, USA (28 Nov 1984).

This paper describes the results of research in progress to evaluate the use of water hyacinth for wastewater treatment and subsequent conversion of hyacinth and sludge to methane by anaerobic digestion. Laboratory studies have been directed toward evaluating advanced biogasification concepts and establishing a data base for the design and operation of an experimental test unit (ETU) located at the water hyacinth wastewater treatment facility at Walt Disney World (WDW) located in Kissimmee, Florida. Laboratory-scale kinetic experiments have been conducted using continuously-stirred tank reactors (CSTR) and a novel non-mixed upflow solids reactor (USR) receiving a hyacinth/sludge blend at retention times of 15 down to 2.1 days. The data suggest that best performance is achieved in the USR which has longer solids and organism retention. A larger-scale ETU (160 cu ft) was designed and installed at WDW in 1983 and started up in 1984. The purpose of this unit is to validate laboratory experiments and to evaluate larger-scale equipment used for chopping, slurry preparation, mixing, and effluent dewatering. The ETU includes a front end designed for multiple feed processing and storage, a fully instrumented USR digester, and tanks for effluent and gas storage. The ETU is currently being operated on a 2:1 blend (dry wt basis) of water hyacinth and primary sludge. Performance is good without major operational problems. Results of laboratory studies and start-up and operation of the ETU will be presented. 7 references, 4 figures, 1 table.

11013 **(DOE/PC/40275—2) Combustion characteristics of synthetic liquid fuels. Quarterly technical progress report,January 1-March 31, 1982.** Beer, J.M.; Cheng, W.K.; Farmayan, W.F.; Gupta, A.K.; Levy, J.M.; Taylor, B.R.; Teare, J.D. (Massachusetts Inst. of Tech., Cambridge (USA)). 7 Jul 1982. Contract AC22-81PC40275. 131p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE85004103.

Second quarter work carried out in three closely-related and interacting Project Elements is reported. Experimental work in the MIT Combustion Research Facility (CRF) included measurements on thirteen flames burning SRC-II middle distillate, part of the baseline studies on unstaged turbulent diffusion flames. Results indicated that emissions of NO/sub x/ and solid particles were minimized by injecting the fuel into the high shear regions of the jet, maintaining the minimum degree of swirl necessary for flame stabilization, and operating at low to moderate excess air levels. Diagnostics which are discussed include the laser light scattering extinction apparatus, the laser velocimeter, the laser diffraction spray distribution analyzer, and the techniques to be used for measurement of ammonia and cyanide species concentrations. Chemical kinetics studies on flat-flame burners have continued. Progress on the measurement of H-atom profiles by the Li/LiOH atomic absorption technique is reviewed, and measured absorption profiles for both sodium and lithium are reported. The C_1/C_2 kinetic model has been improved to give excellent fits with Haynes' data for fuel-rich ethylene/air flames, and a sensitivity study has been carried out. The results indicate that the model is now applicable to the modeling goals of the project. The flame sheet modeling approach to the axisymmetric turbulent diffusion flame has progressed. The calculation of a one-dimensional stretched flame has been completed and a table of the NO/sub x/ formation rate per unit flame surface area has been established for a series of flame surfaces with different fuel/product and oxidant/product compositions. This table is essential for the later computation of the NO/sub x/ formation in a turbulent diffusion flame. 26 references, 27 figures, 8 tables.

11014 **(DOE/R0/00040—T1) Crab waste methane digester. Final report.** Vowell, R.C. (Vowell (R. Charles), Unalaska, AK (USA)). 21 May 1984. Contract FG06-79R000040. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85004506.

Progress is reported on a study to test the performance of a digester producing methane by anaerobically digesting crab wastes. The author concludes that the crab waste digester is impractical if used in a household but cost effective if used in a processing plant. (DMC)

11015 **(DOE/R0/01261—T1) Wood power: experiments with a home-made wood gas generator system, 1982-1984.** Barkas, W.H. II; Sweedler, R. (Barkas (Walter II), Vaughn, WA (USA)). [1984]. Contract FG06-81R001261. 25p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004496.

A wood-burning down-draft gas generator based on an old German war-time design was constructed and tested. The operation is described as well as methods for cooling and cleaning the wood gas. The fuel gas was tested in an internal combustion engine. Off-the-shelf materials were used in the construction. 3 references, 6 figures. (DMC)

11016 **(DOE/R4/10228—T1) Bio-conversion of broiler house litter. Final report.** Harris, T.D. (Harris (Thomas D.), Cleveland, AL (USA)). [1984]. Contract FG44-80R410228. 14p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005448.

Our task was to explore the feasibility of producing enough methane-biogas from chicken litter to significantly effect HVAC expense in a broiler house operation. The primary equipment used was to be converted from equipment found in the agricultural community. Our conclusions are as follows: (1) the potential is great; (2) the time, work, and money involved will prevent all but the most inspired from building a good working digestor system; (3) barring the availability of commercial digestors, the best bet is a bermed or pit digestor (cost/cubic foot); (4) our production rate of six cubic feet of methane/cubic foot of dry substrate (20 day holding cycle) equates to a yield of 1000 to 1250 therms of gas/clean out; (5) one might realistically hope to improve this yield by 10 to 15%. The yield coupled with tax benefits and fertilizer by-product make this a viable option for the mechanically inclined; and (6) we made a mistake by not building a pit type unit. In holding to an objective of portability, we missed the opportunity to work with larger loads and the parameters of pit operation (insulation, etc.). 6 references, 3 figures.

11017 **(DOE/R4/10300—T1) Methane and fertilizer production from seaweed biomass. Final report.** Betzer, P.R.; Humm, H.J. (Humm (Harold J.), St. Petersburg, FL (USA)). [1984]. Contract FG44-80R410300. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005446.

It was demonstrated that several varieties of abundant benthic algae indigenous to Tampa Bay (Gracilaria, Hypnea, and Ulva) were readily degradable via anaerobic digestion to methane. The energy yield per unit weight biomass degraded was higher than any previously reported. Given the large masses of readily degradable plants which are annually produced in and around Tampa Bay, the resource is estimated to be at least equivalent to several million gallons of gasoline.

11018 **(PNL-SA—11885) Overview of DOE's biomass thermochemical conversion process.** Schiefelbein, G.F.; Stevens, D.J.; Gerber, M.A. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1983. Contract AC06-76RL01830. 43p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85005525.

Advanced methods of using thermal energy to generate high value gaseous and liquid fuels as well as heat and electricity from biomass are being studied by DOE. The objective of the Thermochemical Conversion Program is to generate scientific and basic engineering data that will lead to cost-effective conversion processes by exploiting the characteristics of biomass. Field management for the Thermochemical Conversion Program is provided by Pacific Northwest Laboratory (PNL) which has been designated the Lead Laboratory for the Program since 1980. Field management responsibilities of PNL include program planning, selection of research projects, contractual procurement of research activities, and monitoring and evaluation of on-going research projects. Current activities are summarized in this report. Research currently sponsored by the Thermochemical Conversion Program can be divided into three primary technology areas; gasification, liquid fuels production, and innovative combustion processes. Gasification research is directed primarily toward the production of medium-energy gases which could be used as fuel gases or as synthesis gases. The primary emphasis of current combustion research is determining the feasibility of directly using biomass feedstocks to power gas turbine and Stirling engine systems. Liquid fuels research is directed toward the production of alcohol fuels and the utilization of pyrolysis and direct liquefaction techniques to generate a variety of olefinic and aromatic hydrocarbon fuels. 2 references, 18 figures, 2 tables.

11019 **Biomass gasification: principles and technology.** Reed, T.E. (ed.). Park Ridge, NJ, USA; Noyes Data Corporation (1981). 401p. Noyes Data Corp., Mill Rd. at Grand Ave., Park Ridge, NJ 07656 $42.00.

This review of biomass gasification principles and technology will aid in determining the areas of gasification ready for commercialization and those in which further R and D will be most productive. The book presents scientific background information, surveys the status of gasification activities, and examines questions concerning the uses of product gases. Biomass has the potential for being an energy source with few significant environmental drawbacks and some important environmental benefits. Gaseous fuels have been used for more than a century because they are clean burning and easy to distribute. In addition, gases can be converted to liquid fuels or can serve as feedstocks for strategic chemicals. Thus, gasification could continue to supply the convenience gaseous and liquid fuels that the nation has come to depend on during the age of low-cost fossil fuels.

0902 Alcohol Fuels

11020 **(DOE/R4/10460—T1) Solar-powered alcohol still. Final technical report.** Montgomery, J.A. Jr. (Montgomery (John A., Jr.), Columbia, SC (USA)). [1984]. Contract FG44-81R410460. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005435.

The objective of this study was to determine the feasibility of a solar alcohol still to purify ethanol from a concentration normally achieved in a fermentation process to that of reasonable purity (ideally 90 to 95%). Several designs were utilized with varying success. The possibility of distilling alcohol without the use of fossil fuels is very attractive. Although the purity of the alcohol achieved was somewhat less than desired, the concept is promising and further design modifications and/or repeated distillations may prove to be adequate to provide alcohol of useful purity. 24 references, 3 figures.

11021 **(IS-T—1171) Recovery of ethanol from low concentration solution by adsorption with Silicalite.** Ake, T.R. (Ames Lab., IA (USA)). Dec 1984. Contract W-7405-ENG-82. 75p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85004874.

Thesis.

The composition and total mass of the adsorbate, which is present on Silicalite after exposure to liquid or vapor phase mixtures of water and ethanol, are measured. The liquid phase experiment demonstrates that the adsorbent used in this work is similar to that used in previous studies. Silicalite strongly adsorbs ethanol, but the adsorbate recovered is not highly enriched. A recovery process with liquid phase solutions does not appear promising. The composition and mass of the adsorbate are more accurately measured in this study by vapor phase methods. A mass balance is closed to within 1%. The total mass adsorbed is found to agree with predictions of a Langmuir mixture model, which is based on total mass data in a previous study. But the ethanol content of the adsorbate is less than estimated by the model. The adsorbate is found to contain a maximum of 80% by weight ethanol compared to estimate of 85% or more. In addition, the molar selectivity of Silicalite decreases from a value of 4 at moderate ethanol concentrations to 1 at high concentrations. The Langmuir model estimates a fixed value of 14. Use of Silicalite in an adsorption process is suggested for recovering ethanol from low concentration mixtures.

11022 **(PB—85-105401/XAB) Enzymatic conversion of cellulosic materials to sugars and alcohol: the technology and its implications.** Klyosov, A.A. (United Nations Industrial Development Organization, Vienna (Austria)). 12 Jul 1984. 72p. NTIS, PC E04/MF E01.

This UNIDO publication is a review and technology assessment on biotechnology for conversion of cellulose materials to sugar and alcohol.

11023 **(PB—85-108280/XAB) D-xylose fermentation by fusarium oxysporum and other fungi.** Suihko, M.L. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). [1984]. 75p. NTIS, PC E04/MF E01.

Xylose fermentation was studied in order to provide the basis for an economically feasible ethanol production process using sugars derived from biomass. During the study 67 different yeast strains and 27 Fusarium strains were tested. The best strain for xylose fermentation was Fusarium oxysporum VTT-D-80134, which was selected for more extensive experiments. It was found that xylose metabolism in F. oxysporum starts by reduction of xylose to xylitol followed by oxidation to xylulose, yielding ultimately ethanol and carbon dioxide. F. oxysporum was able to ferment all the sugars present in birchwood hydrolyzates, except L-arabinose and L-rhamnose, which were used only for aerobic growth. Xylan was not fermented directly to ethanol due to the inability of the fungus to hydrolyze the polymer to xylose. Continuous fermentation by immobilized F. oxysporum cells was unsuccessful due to the growth of mycelium out from the beads. However, a continuous process with free cells appeared more promising.

11024 **Clean-up of producer and synthesis gas with a tube and wire electrostatic precipitator.** Hoenig, S.A.; Cole, F.L. (Univ. of Arizona, Tucson). *Solar Energy;* **27**: No. 6, 579-580(1981). Contract FG02-80CS84001.

The major problem in the use of wood-generated gas for internal combustion engines has been the dust and tar produced by the combustion process. Earlier attempts to use electrostatic cleaning systems demonstrated the ability to remove tar and particulates but cleaning problems and insulator breakdown resulted in the abandonment of this approach. A tube and wire electrostatic precipitator was used to clean-up the producer gas from a Pegasus-type down-draft generator. The operation and performance of the precipitator are discussed.

14 SOLAR ENERGY

1405 Solar Energy Conversion

REFER ALSO TO CITATION(S) 14050011012, 11015, 11016, 11017, 11018, 11019, 11020, 11023, 11223

11025 **(DOE/ER/13019—2) Zone-melting recrystallization for solar cells. Final report, September 1, 1982-August 31, 1984.** Smith, H.I. (Massachusetts Inst. of Tech., Cambridge (USA)). 31 Aug 1984. Contract AC02-82ER13019. 45p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85004783.

Zone-melting recrystallization (ZMR) of Si on SiO_2 has been investigated to determine if the process can be adapted to produce material configurations suitable for low-cost, high-efficiency photovoltaic cells. In addition, we have demonstrated ZMR of InSb, and begun to establish a practical process for Ge ZMR, with the objective of growing GaAs epitaxially on the Ge. Fundamental recrystallization mechanisms, crystallographic characteristics and electrical properties have been studied. Novel means of controlling crystallographic properties have been developed, including: hourglass, vertical-constriction, entrainment, and orientation-filtering techniques. EBIC studies indicated enhanced dopant diffusion along grain boundaries and subboundaries, and showed that the diffusion length of minority carriers is $\sim 100\mu m$. DLTS studies showed that ZMR films do not contain deep levels associated with impurities, and have interface-state densities comparable to IC-grade Si wafers. A (100) crystallographic texture can be achieved in $50\mu m$-thick ZMR Si films using the vertical-constriction technique. Such films can provide a double pass of incident light and should be suitable for high-efficiency photovoltaic cells. Both two-sided and back-contact cells have been fabricated which showed good blue response and modest efficiency. The ZMR process should enable one to produce thick single-crystal Si films directly on the windows of photovoltaic modules. This should lead to practical, low-cost, high-efficiency single crystal cells.

11026 **(N—84-29346) Radiation Damage Workshop.** Stella, P.M. (Jet Propulsion Lab., Pasadena, CA (USA)). 1984. 2p. NTIS, PC A12/MF A01.

In NASA, Lewis Research Center, Space Photovoltaic Research and Technology, 1983, 253-254, N—84-29307 19-44.

The availability of data regarding the radiation behavior of GaAs and silicon solar cells is discussed as well as efforts to provide sufficient information. Other materials are considered too immature for reasonable radiation evaluation. The lack of concern over the possible catastrophic radiation degradation in cascade cells is a potentially serious problem. Lithium counterdoping shows potential for removing damage in irradiated P-type material, although initial efficiencies are not comparable to current state of the art. The possibility of refining the lithium doping method to maintain high initial efficiencies and combining it with radiation tolerant structures such as thin BSF cells or vertical junction cells could provide a substantial improvement in EOL efficiencies. Laser annealing of junctions, either those formed ion implantation or diffusion, may not only improve initial cell performance but might also reduce the radiation degradation rate.

11027 **(PNL-SA—11546) Standing crop and production in annual grass communities in Washington and California: a comparison.** Rickard, W.H. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1983. Contract AC06-76RL01830. 17p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005523.

An annual grass community in eastern Washington comprised mostly of cheatgrass, Bromus tectorum L., produced a yearly average of 226 g dry wt per m^2 of shoot biomass over a four-year period. Litter averaged 408 g per m^2 and belowground biomass 776 g. Total standing crop averaged 1400 g per m^2. Seventy percent of the root biomass was concentrated in the upper 10 cm of soil profile and 88% was in the upper 20 cm. An annual grass community in the central valley of California was about two times more productive than the cheatgrass community. The major botanical difference between the two communities, other than a more diverse species composition and greater productivity in the California community was the proportion of litter in the total aboveground biomass. The litter component of the cheatgrass community amounted to 30% of aboveground biomass as compared to only 14% for the California community. Litter accumulation in the cheatgrass community may indicate a slower decomposition rate but differences in grazing histories between the Washington cheatgrass and the California communities could have accounted for the difference in litter accumulation. 14 references, 3 figures, 3 tables.

11028 **(PNL-SA—11547) Standing crop and production in an undisturbed shrubsteppe community in eastern Washington.** Rickard, W.H.; Sauer, R.H. (Pacific Northwest Lab., Richland, WA (USA)). Jul 1983. Contract AC06-76RL01830. 23p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005522.

Standing crop and production were investigated in an relatively undisturbed (ungrazed) shrubsteppe plant community in southeastern Washington. Total standing crop was 1600g dry weight per m^2 with 460g aboveground and 1140g belowground. Grass crowns, litter and standing dead herbaceous plants amounted to 127g and sagebrush shrubs 270g. Twenty-five percent of the belowground biomass was in the upper decimeter of soil profile and 41% in the first two decimeters. Over a 4-year period, aboveground production averaged 70g per m^2 per y, about 10g of this amount was produced by sagebrush shrubs. About 10 g of herbaceous shoot biomass was produced during the autumn and winter months and 60 g in April, May and early June. The average rate of herbaceous shoot biomass production was 0.66 g per m^2 per day over a 75-day period in the spring. Year to year herbaceous shoot biomass production ranged between 50 and 69 g per m^2 at peaks yields. This is a relatively small range as compared to growing season precipitation totals which ranged between 8.1 and 22.6 centimeters. Shoot productivity in this shrubsteppe community was at the low end of the ranges cited in the literature for other kinds of semi-arid steppe communities in the western United States. 19 references, 3 figures, 6 tables.

11029 (SAND—84-1167, pp 9-14) **Comparison of concentrating collectors to tracking flat panels.** Jones, G.J. (Sandia National Laboratories, Albuquerque, NM). Aug 1984. NTIS, PC A07/MF A01. File Number DE84017456. (CONF-840561—Exc.).

From 17. IEEE photovoltaic specialists conference; Orlando, FL, USA (1 May 1984).

Two-axis tracking appears to be the economic optimum for photovoltaic flat-panel technology. This requires a new comparison of flat-panel and concentrator arrays using the most competitive flat-panel option. The array field costs for a two-axis tracking flat-panel should be nearly identical to the cost for a concentrator. Therefore, module costs for the two technologies can be compared directly, simplifying the analysis. For example, at southwestern sites, characterized by a high direct-to-diffuse insolation ratio, 12% flat-panels are found to be equivalent to 15% concentrators of the same cost ($/$m^2$). For regions with more diffuse radiation the concentrator must be over 18% efficient to be equivalent.

11030 (SAND—84-1167, pp 45-54) **Development of the Sandia 200X experimental silicon module.** Arvizu, D.E. (Sandia National Laboratories, Albuquerque, NM). Aug 1984. NTIS, PC A07/MF A01. File Number DE84017456. (CONF-840561—Exc.).

From 17. IEEE photovoltaic specialists conference; Orlando, FL, USA (1 May 1984).

The design and development of an experimental photovoltaic concentrator module is described. This module, which was designed to investigate performance loss mechanisms, features twelve series connected, state-of-the-art, silicon concentrator cells each with a reflecting cone secondary mounted on an actively cooled heatsink. Each cell has position adjustment in three axes to allow spatial fine tuning of the cell with respect to its corresponding Fresnel lens. Recent outdoor testing in Albuquerque, New Mexico has demonstrated that this module has a peak solar-to-electric conversion efficiency of 17.0 +/- .3% under an 800 W/m^2 AM1.5 reference spectrum with a cell temperature of 25°C. These results represent the highest module conversion efficiency ever obtained using silicon cells.

11031 (SAND—84-1167, pp 63-66) **Strained superlattice, quantum well, multijunction photovoltaic cell.** Chaffin, R.J.; Osbourn, G.C.; Dawson, L.R.; Biefeld, R.M (Sandia National Laboratories, Albuquerque, NM). Aug 1984. NTIS, PC A07/MF A01. File Number DE84017456. (CONF-840561—Exc.). Contract AC04-76DP00789.

From 17. IEEE photovoltaic specialists conference; Orlando, FL, USA (1 May 1984).

A novel lattice-matched multijunction cell is proposed. The cell makes use of the electronic and mechanical properties of the Strained-Layer Superlattice (SLS). With the SLS is it possible to vary the lattice constant and bandgap of a semiconductor independently. Experimental demonstration of the technology building blocks of such a cell are shown.

11032 (SAND—84-1167, pp 77-82) **Effective monatomic hydrogen diffusion constants in polycrystalline silicon.** Ginley, D.S.; Hellmer, R.P. (Sandia National Laboratories, Albuquerque, NM). Aug 1984. NTIS, PC A07/MF A01. File Number DE84017456. (CONF-840561—Exc.). Contract AC04-76DP00789.

From 17. IEEE photovoltaic specialists conference; Orlando, FL, USA (1 May 1984).

The passivation of grain boundaries in polycrystalline silicon with monatomic hydrogen has demonstrated considerable potential for improving thin film and ribbon solar cell efficiencies. Very little is known of the chemistry and kinetics of this process. A technique was developed which allows an estimation of the monatomic hydrogen diffusion constant for grain boundary diffusion in bulk polycrystalline silicon. A diffusion rate for grain boundaries in the bulk material was observed that was comparable to that observed previously for individual boundaries. A near surface enhanced passivation rate which can be effectively modeled by the incorporation of a second diffusion constant into the diffusion equation was also observed.

11033 (SAND—84-1167, pp 83-90) **Solar spectrum influence on the annual performance of AlGaAs/Si stacked cells.** King, D.L.; Siegel, R.B. (Sandia National Laboratories, Albuquerque, NM). Aug 1984. NTIS, PC A07/MF A01. File Number DE84017456. (CONF-840561—Exc.).

From 17. IEEE photovoltaic specialists conference; Orlando, FL, USA (1 May 1984).

An analytical model for calculating the annual performance of mechanically stacked multibandgap solar cells has been developed. This capability was used to investigate the potential performance of AlGaAs on Si stacked cells under concentrated sunlight. For series connected cells, the optimum AlGaAs bandgap was found to be approximately 1.75 eV. For independently connected cells, AlGaAs bandgaps from 1.42 to 1.90 eV were near optimal. For a 1.75 eV AlGaAs cell, the annual penalty resulting from series connection to a silicon cell was found to be minimal (<3%). An annual efficiency of over 40% was calculated for ideal optical and cell performance parameters. However, for cell parameters and op-

tical losses typical of current technology, the calculated annual efficiency was approximately 25%

11034 (SAND—84-1167, pp 91-96) **Characterization of performance loss mechanisms in a concentrating photovoltaic module.** King, D.L.; Chiang, C.J. (Sandia National Laboratories, Albuquerque, NM). Aug 1984. NTIS, PC A07/MF A01. File Number DE84017456. (CONF-840561—Exc.).

From 17. IEEE photovoltaic specialists conference; Orlando, FL, USA (1 May 1984).

The performance loss mechanisms in three current design photovoltaic concentrator modules have been identified and quantified. The concentrator modules evaluated include the following: Martin Marietta second generation, Sandia baseline module, and Sandia 200X experimental module. The primary loss in performance was due to the Fresnel lens efficiency (82 to 86%). Series resistance added during module assembly contributed as much as a 5% loss. Nonuniform cell illumination also resulted in a 5% loss. Mismatch in the I-V characteristics of individual cells was found to be a negligible loss in all three modules.

11035 (SERI/CP—211-2507) **Photovoltaic advanced research and development 6th annual review meeting. Abstracts.** (Solar Energy Research Inst., Golden, CO (USA)). 1984. Contract AC02-83CH10093. 88p. (CONF-841021—Absts.). NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE84013047.

From 6. SERI photovoltaic research and development review meeting; Golden, CO, USA (29 Oct 1984).

Brief summaries are given for 55 presentations given at this meeting. Areas covered include: amorphous silicon, polycrystalline thin-film materials and devices, characterization and measurements research, high efficiency silicon and other high efficiency concepts. (LEW)

11036 (SERI/STR—211-2475) **Compensation of dangling bonds in A-Si, Ge:H alloys. Annual report.** Lucovsky, G.; Cook, J.W. Jr.; Rudder, R.A.; Pollard, W.B.; Lin, S.Y. (North Carolina State Univ., Raleigh (USA). Dept. of Physics). Oct 1984. Contract AC02-83CH10093. 94p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85002905.

This presents a summary of results of deposition of a-Si:H, a-Ge:H and a-Si,Ge:H by dual magnetron sputtering. Principal experimental techniques are infrared and Raman spectroscopy, conductivity, and optical absorption. Theoretical calculations are made using semi-empirical tight-binding Hamiltonians to study bonding defects in a-Si and a Si-based alloys. Theoretical studies of hydrogen and impurity bonding and their associated defect levels are reviewed. This report also contains reprints of 11 published papers which describe the summarized results in detail.

11037 (SERI/STR—211-2557) **Structural and electronic properties of amorphous-silicon-based alloy materials. Final report, June 1983-May 1984.** Biegelsen, D.K.; Jackson, W.B.; Boyce, J.B.; Johnson, N.M.; Nemanich, R.J.; Street, R.A.; Stutzmann, M.; Thompson, M.J.; Thompson, R.; Tsai, C.C.; Zesch, J.C. (Xerox Palo Alto Research Center, CA (USA)). Oct 1984. Contract AC02-83CH10093. 43p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85002909.

The research described in this report covers the structure and electronic properties of hydrogenated amorphous silicon and its alloys, emphasizing localized states in the gap and interface states. ESR and photoconductivity studies of prolonged illumination have led to a new model for the Staebler-Wronski effect, in which extra dangling bonds are created as a consequence of recombination. There is new evidence that the effect does not require the presence of impurities. DLTS and optical studies of gap states confirm that the dangling bond states are near mid-gap. Detailed information is presented concerning their role as recombination centers, through luminescence, ESR, and photoconductivity experiments. New localized states associated with phosphorus impurities have been observed by ESR, although their structural identity is not yet known. Time-of-flight measurements of compensated a-Si:H show that although the dangling bond density is low, compensation introduces other states near the band edges that could be boron-phosphorus complexes. Inverse photoemission has measured the conduction band density of states, identifying Si-H antibonding states and the approximate location of the mobility edge. NMR experiments find that thin films of a-Si:H have an excess hydrogen concentration and a new relaxation mechanism observed above 200°K with an unknown origin. A wide variety of a-Si:H interfaces have also been studied.

11038 (SERI/STR—211-2558) **Thin-film polycrystalline silicon research. Final report, August 1983-August 1984.** Anderson, W.A. (State Univ. of New York, Buffalo (USA)). Oct 1984. Contract AC02-83CH10093. 64p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85002908.

This report contains results of research conducted to explore high-efficiency Si solar cell design concepts primarily utilizing high-quality Si substrates, shallow junctions, and passivated surfaces. Computer-aided design was used to select substrate resistivity, implant energy and dose, and A/R coating design. Several possible grid metals were investigated, including magnesium, ytterbium, titanium, and chromium. Ytterbium gave the best results. Several grid designs were used. Textured surfaces were considered to increase short-circuit current density. Ion-implanted cells were furnace-annealed and rapid flash-lamp annealed; best results were obtained from furnace annealing. I-V-T tests revealed conduction mechanisms for excess currents, which led to improved preparation of solar cell edges and increased efficiency. Three designs, MINP, MNP-P, and MINP-P, were examined. The best implanted cell was the MINP design, with 18.5% AA efficiency and 15.6% TA efficiency. The best diffused cell gave 14.9% AA efficiency and 14.0% TA efficiency. Cl-containing I-layers exhibited improved efficiency, increased uv response, reduced surface state density, and better environmental stability.

11039 **Applicability of the Meyer—Neldel rule to solar cells.** Goradia, C.; Weizer, V.G. (Cleveland State University, Cleveland, Ohio 44115). *Applied Physics Letters;* **45**: No. 12, 1298-1300(15 Dec 1984).

A comparison of data taken on high quality silicon, GaAs, and GaInAs solar cells with those taken on a variety of homojunction, heterojunction, and metal-insulator-semiconductor devices indicates that while the Meyer—Neldel rule may be applicable to certain types of solar cells it is not applicable to well-behaved, diffusion-controlled homojunction devices. It cannot be used, therefore, as a universal rule to predict maximum achievable solar cell voltages.

11040 **Biomass chemical production by thermochemical conversion.** Klausmeier, W.H. (Argonne National Lab., IL). *Biotechnology and Bioengineering Symposium;* No. 13, 81-97(1983).

Concepts are reviewed for the production of chemicals by the thermochemical conversion of biomass. An engineering and economic analysis builds upon recent laboratory developments to provide a perspective of new process potentials and identifies areas requiring further investigation. Candidate processes fall into two categories: (1) production of acetate esters, vinyl acetate, and acetic anhydride by biomass gasification; and (2) production of aromatic chemicals by the hydroprocessing of biomass. Engineering design bases are developed from fundamental data and process economics are then estimated and compared to conventional routes to the same products. 13 references, 10 figures, 9 tables.

11041 **Determination of the grain boundary recombination velocity in polycrystalline silicon as a function of illumination from photoconductance measurements.** Panayotatos, P.; Yang, E.S.; Hwang, W. (Columbia Univ., New York, NY). *Solid-State Electronics;* **25**: No. 5, 55-60(1982).

The grain boundary recombination velocity of polycrystalline Si is separated from bulk effects and its value is determined with practically no assumption of numerical values for any parameter other than the minority carrier diffusion coefficient. The method used utilizes photoconductance measurements taken by the scanning laser spot technique. It is found that, for the illumination levels used, there is a transition from low level to high-level injection of minority carriers, and this transition is used to estimate the quasi-Fermi level separation. The recombination velocity S, ranging

is value from 5000 to 17000 cm/sec, is thus presented both as a function of the illumination level as well as of the quasi-Fermi level separation ΔE/sub f/. It is found that S increases monotonically with illumination and does not saturate, even at the high light concentrations used.

1406 Photovoltaic Power Systems

11042 **(DOE/CS/30076—T1) Federal Photovoltaic Utilization Program. Final report.** (Army Belvoir Research and Development Center, Fort Belvoir, VA (USA)). 17 Sep 1984. Contract AI01-79CS30076. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005387.

The Federal Photovoltaic Utilization Program (FPUP) was established to promote the use of photovoltaic power systems in the federal government and accelerate the growth of a commercially viable US industry in photovoltaic systems. US Army Belvoir Research and Development Center (formerly MERADCOM) administered the Army's program under FPUP. Funding was received in FY80 for this program. The projects approved by DOE under FPUP were grouped together for technically similar designs and procured under four separate procurement actions. Group 1 included small dc photovoltaic power supplies used on remote test ranges for powering instrumentation. Group 2 consisted of two remote stand-alone photovoltaic ac power systems. Group 3 contained trailer mounted photovoltaic ac power systems for instrumentation on test ranges. Finally, Group 4 was a study of the feasibility of photovoltaic power systems for fixed military facilities and included a hardware system. The project groups 1, 2, and 3 were conducted by Belvoir Research and Development Center. Group 4 was conducted by the US Army Construction Engineer Research Laboratory. The system hardware was procured competitively from photovoltaic system suppliers. All systems were delivered, installed, and operational by December 1983. The photovoltaic systems have met performance design requirements. The users in general have expressed satisfaction with the capabilities of their systems. FPUP has helped DOE in commercialization of photovoltaics by exposing the federal agencies to the potential of photovoltaic which has resulted in additional photovoltaic system procurements by the federal agencies.

11043 **(DOE/CS/94277—T1) 50 kW on-site concentrating solar photovoltaic power system. Phase I: design. Final report, 1 June 1978-28 February 1979.** Pittman, P.F. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center). 30 Mar 1979. Contract AC04-78CS94277. 182p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE85004958.

This contract is part of a three phase program to design, fabricate, and operate a solar photovoltaic electric power system with concentrating optics. The system will be located beside a Local Operating Headquarters of the Georgia Power Company in Atlanta, Georgia and will provide part of the power for the on-site load. Fresnel lens concentrators will be used in 2-axis tracking arrays to focus solar energy onto silicon solar cells producing a peak power output of 56 kW. The present contract covers Phase I which has as its objective the complete design of the system and necessary subsystems.

11044 (SAND—84-1167, pp 31-36) **Grid-connected PV systems: How and where they fit.** Thomas, M.G.; Jones, G.J. (Sandia National Laboratories, Albuquerque, NM). Aug 1984. NTIS, PC A07/MF A01. File Number DE84017456. (CONF-840561—Exc.).

From 17. IEEE photovoltaic specialists conference; Orlando, FL, USA (1 May 1984).

The use of grid-connected photovoltaic systems requires substantial improvements in system economics. By integrating anticipated improvements in economics with consumer needs and perceptions, we have order-ranked the various potential applications. Third-party ownership of large systems appears to have the largest potential, residential has a modest potential, and the intermediate dedicated-load application potential appears to be small.

11045 (SAND—84-1167, pp 119-126) **Photovoltaic power-conditioning performance evaluation, lessons learned.** Bower, W.I.; Key, T.S.; Petterson, B.J. (Sandia National Laboratories, Albuquerque, NM). Aug 1984. NTIS, PC A07/MF A01. File Number DE84017456. (CONF-840561—Exc.). Contract AC04-76DP00789.

From 17. IEEE photovoltaic specialists conference; Orlando, FL, USA (1 May 1984).

A detailed evaluation of photovoltaic power conditioners has identified critical design characteristics. The units being tested are for single-phase grid-connected applications. The overall performance of recent prototypes is excellent; however, exposure to extreme physical and electrical environments has pointed out some weaknesses. In most cases the weaknesses are not inherent to the designs and can be corrected, once discovered. A set of lessons learned that highlights the best design aspects and the common problem areas found in PCS hardware are presented. Areas evaluated include utility interface and array interface compatibility, temperature extremes, emanations by and impingements on the unit, maintainability, and reliability.

11046 (SAND—84-1167, pp 127-132) **Operation and maintenance experience at intermediate-sized photovoltaic projects.** Burgess, E.L.; Harrison, T.D.; Fernandez, J.P. (Sandia National Laboratories, Albuquerque, NM). Aug 1984. NTIS, PC A07/MF A01. File Number DE84017456. (CONF-840561—Exc.).

From 17. IEEE photovoltaic specialists conference; Orlando, FL, USA (1 May 1984).

Operation and maintenance (O and M) costs for two intermediate-sized photovoltaic projects are evaluated for a one-year period after start-up for each project was complete. O and M costs are calculated for both the concentrating system at the Dallas-Fort Worth Airport in Texas and the fixed flat-plate system at the Lovington Square Shopping Center in Lovington, NM. Factors contributing to the O and M costs for each system are discussed.

11047 (SAND—84-1167, pp 145-150) **Effects of reflector augmentation on fixed polycrystalline arrays.** Harrison, T.D. (Sandia National Laboratories, Albuquerque, NM). Aug 1984. NTIS, PC A07/MF A01. File Number DE84017456. (CONF-840561—Exc.).

From 17. IEEE photovoltaic specialists conference; Orlando, FL, USA (1 May 1984).

The 130-kW photovoltaic system located on the roof of the Omniplex in Oklahoma City, OK was designed with mirrors to increase the amount of solar radiation that strikes the modules during the intervals between spring and autumn equinox and so increases the power generated by the array. The design intent was to produce 130 kW at noon on summer solstice; however at no time has the array produced more than 100 kW. Sandia National Laboratories, Albuquerque, designed a multiphase experiment to determine the reason that the array failed to meet the design intent. The experiment, the results obtained, and the lessons learned are described.

1407 Solar Thermal Power Systems

11048 (SAND—84-1167, pp 23-30) **Utility interface: can state-of-the-art power conditioners alleviate our concerns?.** Stevens, J.W.; Key, T.S. (Sandia National Laboratories, Albuquerque, NM). Aug 1984. NTIS, PC A07/MF A01. File Number DE84017456. (CONF-840561—Exc.). Contract AC04-76DP00789.

From 17. IEEE photovoltaic specialists conference; Orlando, FL, USA (1 May 1984).

A key issue in adding significant amounts of photovoltaic (PV) generated electricity to the US electric grid is the PV/utility interface. The four most commonly discussed interface issues: harmonic content of the PV system output, power factor at which the system operates, voltage flicker potential attributed to cloud movement over the PV arrays, and automatic disconnection of the PV system during a utility outage are presented. For each of these topics, a brief discussion of the concerns is followed by relevant re-

sults of recent research. The role that power conditioning plays in the interface and the direction of on-going research is delineated.

11049 **(SAND—84-8183) 10 MWe Solar Thermal Central Receiver Pilot Plant Mode 5: Charging Only acceptance test procedure 1150.** (McDonnell Douglas Astronautics Co., Huntington Beach, CA (USA)). Dec 1984. Contract AC04-76DR00789. 113p. NTIS, PC A06/MF A01; GPO Dep. File Number DE85005303.

During Mode 5 (Charging Only) operation, the plant is operated in a sun following control strategy under manual control. All of the receiver steam flows to the thermal storage charging heat exchangers to heat the Thermal Storage Unit oil. The total steam flow and resulting charge rate may fluctuate significantly depending on the amount of thermal (solar) power supplied to the plant. Operator control over input power is limited to commanding selected heliostats to Track or Standby. The overall objective of the 1150 test series is to demonstrate satisfactoru Mode 5 operation in all possible control/operating configurations associated with this mode. The objective is also to verify published operating procedures or to modify the procedures as required to satisfy the operating intent of the plant. The actual procedures themselves (step-by-step activities) will be evaluated against currently published operating procedures. In the event selected steps of the procedure do not produce the desired condition or better ways of achieving the desired conditions are identified, the operating procedures will be revised to support subsequent testing. It is also intent of this procedure to gather limited quantities of plant performance data from which initial performance evaluations can be made. Subsequent operational tests can be geared to specific performance studies which may arise as a result of preliminary data analysis. The subsections and flow of the 1150 test procedure are shown with the composite (charging and extraction) Thermal Storage Subsystem (TSS) Piping and Instrumentation Diagram (P and ID).

1408 Ocean Energy Systems

11050 **(FSEC-CR—108-84) Thermoeconomic optimizarion of OC-OTEC electricity and water production plants. Final report.** Block, D.L.; Girgis, M.A.; Huggins, J.C.; McCluney, R.; Rotundo, L.; Valenzuela, J.A.; Hutchings, B.J.; Stacy, W.D.; Sam, R.G.; Patel, B.R. (Florida Solar Energy Center, Cape Canaveral (USA); Creare R and D, Inc., Hanover, NH (USA)). Sep 1984. Contract AC02-77CH00178. 381p. (CREARE/TM—977). NTIS, PC A17/MF A01; 1; GPO Dep. File Number DE85005221.

The objectives of this yearlong project were to: (1) assess the economic and technical viability of open-cycle ocean thermal energy conversion of (OC-OTEC) for the production of electricity and/or fresh water based on the current state of the art; (2) develop conceptual designs of optimized OC-OTEC plants that produce electricity and/or fresh water for plant sizes that are economically attractive; and (3) identify the research issues that must be resolved before a commercial plant can be built. Oceanographic data for six potential sites were evaluated and generic site characteristics were developed. The generic site has a 20°C temperature differential between the ocean surface and a depth of 1000 m. This temperature differential occurs at a distance of 5 km from shore. Current and projected prices and requirements for electricity and water at potential sites were obtained. The state of the art of components comprising the OC-OTEC plant was reviewed. Design options for each component were identified. The highest performing, least costly, and least technically uncertain design for each component was selected. Component cost and performance models were then developed and integrated into thermoeconomic system models for single- and double-stage OC-OTEC plants that produced electricity and/or fresh water. A computerized optimization procedure was developed to obtain optimal (minimum cost) plant configurations for the production of electricity and/or fresh water. All plant types - floating, moored, shelf-mounted, shallow-water and land-based plants - were evaluated. Based on the state-of-the-art and typical characteristics of potential sites, the primary thrust of the program was directed towards shallow-water and land-based plants. The shallow-water/land-based plant configurations selected had a 5-km long cold-water supply pipe and a 1-km long discharge pipe for the evaporator and condenser.

1409 Solar Thermal Utilization

REFER ALSO TO CITATION(S) 14090011020

11051 **(DOE/CS/31587—T3-Vol.1) Development of a single-family absorption chiller for use in a solar heating and cooling system. Phase III, final report. Volume I.** Reimann, R.C.; Biermann, W.J. (Carrier Corp., Syracuse, NY (USA). Energy Systems Div.). Oct 1984. Contract AC03-77CS31587. 209p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE85003217.

This is a hardware oriented project to demonstrate the feasibility of the solar fired, air cooled, absorption cooling of residential and commercial buildings. Beginning with design accuracy property data on a new chemical system applicable to air cooled absorption equipment, a breadboard machine was constructed in order to gain experience with system dynamics, chemical stability and overall performance. Employing heat transfer data and operating characteristics obtained from the breadboard an attempt was made to design and build a first generation prototype. A problem with the first heat transfer additive used caused the absorber to operate unsatisfactorily. A second, more refined, prototype was designed, constructed and tested incorporating the previous experience and heat transfer data as well as a new heat transfer additive. Although this prototype did not quite meet design capacity (85%), it surpassed design COP (0.75 vs 0.72) and performed stably without the signs of chemical degradation present in the previous prototype. Two more identical machines are being operated during field test in actual solar systems. After the successful operation of the 10 kW machine, it was decided to design and construct a larger scaled-up prototype for use in commercial applications. An appropriate size seemed to be about 70 kW. After considerable design effort a satisfactory size and design was achieved and constructed. In general, the 70 kW machine behaved much like the 10 kW, again producing about 80% of capacity but with varying COP's (probably due to the transient nature of the testing).

11052 **(DOE/CS/31587—T3-Vol.2) Development of a single-family absorption chiller for use in a solar heating and cooling system. Phase III, final report. Volume II.** Reimann, R.C.; Biermann, W.J. (Carrier Corp., Syracuse, NY (USA). Energy Systems Div.). Oct 1984. Contract AC03-77CS31587. 132p. NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE85003218.

The appendices provide supporting information on: properties of a chemical system for solar fired, air-cooled absorption equipment, air-side performance of a one-inch tube, absorber plate-fin coil, listings of the programs used for simulation and data reduction, and evaluation of the Carrier 3-ton chiller in an integrated heating and cooling system. (LEW)

11053 **(DOE/ET/20645—1) Engineering field test of a solar cooling system, data item No. 12. Final report, Phases I, II and III.** Anderson, W.E. (Honeywell, Inc., Roseville, MN (USA). Technology Strategy Center). May 1983. Contract FC02-80ET20645. 302p. NTIS, PC A14/MF A01; 1; GPO Dep. File Number DE85000736.

The program plan outlined a comprehensive three-phase effort for the design, fabrication, assembly, and field test of the advanced solar cooling system. Phase I, Cooling Equipment Design and Analysis, was a study of 6 months' duration and encompassed tasks requiring equipment design, equipment analysis, economic analysis of the system, and evaluation of the potential for commercialization. Phase II, Detailed Installation Design and Construction, was an effort of 12 months' duration and included the tasks of installation-related design, site-related instrumentation, system fabrication and installation, and performance-based acceptance testing. Also included in this phase were preliminary and critical design reviews. Phase III, Test of Prototype Systems, was an effort of 18 months' duration and included operational performance monitoring and system maintenance support.

1410 Solar Collectors And Concentrators

11054 (BNL—35279) Brookhaven National Laboratory's low cost solar technology. Wilhelm, W.G. (Brookhaven National Lab., Upton, NY (USA)). Sep 1984. Contract AC02-76CH00016. 6p. (CONF-8409196—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85004160.

From CAL/SEIA annual meeting on technology transfer; Anaheim, CA, USA (15 Sep 1984).

The problems identified in early study - cost, architectural compatibility, and reliability - were not likely to be solved with conventional practices in the solar industry. BNL then embarked upon an iterative development process towards a solution founded on the methodology which establish a set of key guidelines for the research. With the derivation of cost goals ($5 to $6 per square foot, installed) and performance targets (consistent with conventional technology) it was considered important to use sophisticated industrial product development technologies to achieve the desired results. The normal industrial practice to reduce cost, for example, is to reduce material intensity, strive for simplicity in design and apply as much mass production as possible. This approach revealed the potential of polymer films as a basic construction material for solar collectors. Further refinements to reduce cost were developed, including the perfection of a non-pressurized absorber/heat exchanger and the adaptability of a printable optical selective surface. Additional significant advantages were acquired through application of a monocoque construction technique borrowed from the aircraft industry. The procedures used, including important support from industry to help identify materials and guide fabrication techniques, eventually resulted in construction and successful testing of a thin polymer film solar collector. To achieve the overall objectives of viable solar economics some system concepts have been explored by BNL. Consistent with the cost goals mentioned, it is believed that the low pressure designs pursued will be successful. Designs for the storage tank and distribution system that have been pursued include the use of polymer film lined sheet metal for the storage tanks and plastic pipe.

11055 (DOE/AL/16222—T1) Corrosion resistance of metallic solar absorber materials in a range of heat transfer fluids. Final technical report. Brock, A.J.; Smith, E.F. III. (Olin Corp., New Haven, CT (USA). Metals Research Lab.). 1983. Contract AC04-81AL16222. 180p. NTIS, PC A09/MF A01; GPO Dep. File Number DE85004586.

The work described in this report is intended to provide manufacturers, designers, and installers with reliable corrosion compatibility data, meaningful maintenance schedule, and confidence in durability and performance of solar collector units. The corrosion behavior of Cu alloy 122, Al alloy 1100, mild steel 1010, and a ferritic stainless steel (alloy 444) was determined in a variety of potential solar heat transfer fluids. The fluids included potable waters, water glycol solutions, and four non-aqueous fluids. The test apparatus cycled the temperatures of the fluids through those typical of an operating solar energy collector unit. The 444 stainless steel was the most corrosion resistant material and in uninhibited solutions demonstrated only extremely shallow pits during the 180 day test. The use of inhibited solutions generally prevented pits from forming. Cu alloy 122 showed quite low corrosion rates in uninhibited solutions although the presence of excess solder flux promoted some crevice corrosion. In such solutions, uniform, corrosive attack produced general surface roughening along with a protective surface oxide. The overall corrosion rate of the alloy was generally lower in inhibited glycol solutions although pitting within the crevice region occurred in limited cases. Exposure in the non-aqueous fluids resulted in extremely low corrosion rates with little evidence of localized attack.

11056 (DOE/CS/35308—T1) Protection of Lexan from uv radiation by photodownconversion. Final report. Yen, W.M.; Yu, H. (Wisconsin Univ., Madison (USA)). 1980. Contract AC04-78CS35308. 28p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85005414.

Photodownconversion of uv radiation incident on a polymeric substrate, Lexan, into visible and IR region is effected by coating the substrate with cerous chloride ($CeCl_3$)/poly(vinyl alcohol) complex whereby photolytic degradation of the substrate is significantly inhibited. Thus it appears that cerous ion coating serves as an effective uv screener. The testing method consists of exposing the coated and naked substrate films to a medium intensity uv source with a cut-off filter below 280 nm for different intervals and determining their optical transmission characteristics. Some of the cerous ion coated films were further overcoated with poly(vinyl acetate) in order to prevent ion leaching by water. The final product retains the visible and IR transmittance of untreated Lexan film, and when the optimum composition of $CeCl_3$ in poly(vinyl alcohol) is coated, its transmission spectrum is barely changed even after 24 hours of uv irradiation which is estimated as equivalent to 2 years of solar radiation at Chicago, Illinois. The overcoating of poly(vinyl acetate) however, gradually allows permeation of humidity whereby phase separation of cerous chloride from the poly(vinyl alcohol) matrix takes place in about 6 to 8 months under ambient conditions. The attending deterioration of the optical transmission characteristics essentially prohibit long term storage of these films. In order to render the complexing matrix less hygroscopic and to bypass the need for overcoat, poly(vinyl butyral) was tried as the integral layer. Its efficacy for solarization inhibition of Lexan is reduced due to smaller amounts of cerous ion incorporated into the matrix but the phase separation problem is avoided. Fine tuning of these two conflicting factors is not yet achieved.

11057 (DOE/ER/10575—T2) Fundamentals and techniques of nonimaging optics. Final report. Winston, R.; O'Gallagher, J.J. (Chicago Univ., IL (USA). Enrico Fermi Inst.). 1983. Contract AC02-80ER10575. 108p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85004922.

A new formalism for analyzing nonimaging systems in terms of a quantity called the geometrical vector flux was developed and a number of new ideal concentrator designs were discovered and tested. Work has been done to extend this formalism with the goal of applying the analysis to non-ideal concentrators. Both phase space and vector flux representations for traditional concentrators have been generated. Our understanding of the thermodynamically derived relationship between concentration and cavity effects has led to the design of new lossless and low loss concentrators for absorbers with gaps. Quantitative measurements of the response of real collector systems and the distribution of diffuse insolation shows that in most cases performance exceeds predictions in solar applications. Under the most recent phase of this effort a number of significant advances have been made. Most important is the formal extension of the Brightness Theorem in geometrical optics (the analogue of Liouville's theorem) to the physical optics domain. This work has been used to show that the claims advanced for several proposed holographic concentrators must be carefully evaluated and in many cases cannot be true. Other theoretical work introduced the concept of a pseudopotential satisfying Laplace's equation and certain well-defined boundary conditions from which the vector flux field J can be derived. Applications work has included new efforts in secondary concentrator design for both photovoltaic and thermal systems. In the latter case the first test of the trumpet or flow line concentrator was carried out. Computer modeling techniques both for optical design evaluation using improved ray-tracing methods and for materials parameters optimization (e.g., selective surfaces) were developed.

11058 (DOE/SF/11646—T1) Testing of Zeopower solar collectors for heating and cooling. Final report. (Collier Engineering, Cave Creek, AZ (USA)). 7 Jun 1982. Contract AC03-82SF11646. 22p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005470.

Four Zeopower solar collectors were tested for both heating and cooling performance. The testing period was thirty days for each mode. Testing in both heating and cooling modes were designed to simulate actual operating conditions. Heating performance was measured against preset tank temperatures up to 140°F. Cooling performance was measured against entering fluid temperature, ambient temperature and 55°F. Considerable difficulty was encountered with the collectors ability to maintain a hermetic seal within the zeolite cavity. The collectors were totally inoperative during the heating testing and partially inoperative during the cooling testing. Cooling performance was close to that previously published by the manufacturer when compared against entering fluid tempera-

ture. However, the collectors were not able to continuously cool the fluid to below ambient and never cooled the fluid to chiller temperatures for the test conditions.

11059 **(SAND—84-8251) Solid particle receiver experiments: radiant heat test.** Hruby, J.M.; Steele, B.R.; Burolla, V.P. (Sandia National Labs., Livermore, CA (USA)). Dec 1984. Contract AC04-76DR00789. 79p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85005302.

In tests designed to simulate the fundamental characteristics of a solar thermal solid particle central receiver, a continuous stream of free-falling particles has been heated to temperatures in excess of 1300 K over a ten meter fall height in the presence of a radiant flux of 0.50 MW/m². The ability to heat particles to temperatures this high is a major step in demonstrating the technical feasibility of the solid particle receiver concept. Particle temperatures were varied by altering mass flow rate, incident radiant flux, and particle size and optical properties. Flux levels were varied between 0.10 and 0.50 MW/m² for silicon carbide and silica sand particles with nominal sizes of 300 μm, 500 μm and 1000 μm. Particle generated convection currents increased particle residence times by as much as a factor of three. No particle sintering effects were observed.

11060 **(SERI/SP—271-2470) Solar ponds: a selected bibliography.** (Solar Energy Research Inst., Golden, CO (USA)). Nov 1984. Contract AC02-83CH10093. 41p. NTIS, PC A03/MF A01; GPO Dep. File Number DE84013031.

This bibliography contains 578 citations of literature in these areas: general descriptions of shallow, saturated, or salt gradient solar ponds; specific descriptions of solar ponds, either natural, converted from existing bodies of water, or constructed, thermal performance of solar ponds, including collection efficiency, ground losses, and storage; fluid mechanics of solar ponds, including the surface layer, gradient layer, storage layer, and withdrawal and injection of brine; mass transfer; design and construction; operation and maintenance; environmental effects and safety; instrumentation; economics; applications; site specific studies; and patents. (LEW)

1420 Heat Storage

11061 **(DOE/OR/21400—T81) Overview of latent storage for passive solar applications.** Tomlinson, J.J. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005354.

While state of the art passive solar systems can satisfy a portion of the space heating needs in many locations in the US, analyses of typical building heating requirements and available solar radiation indicates that the solar flux on a horizontal or south-facing vertical surface is sufficient to meet the entire building heating load during the winter. Since buildings consume approximately one-third of the primary energy budget, and space heating for these buildings is a major component, significant reductions in purchased energy requirements for buildings are possible through development and implementation of new, advanced, cost effective passive solar technologies. This paper provides an overview of passive solar storage techniques, available products and selected current research activities.

15 Geothermal Data And Theory

REFER ALSO TO CITATION(S) 15200010996

16 TIDAL AND WAVE POWER

1608 Wave Energy Converters

11062 **(NEL-Trans—2908) Model tank tests to improve the output of the wave power generator .** (National Engineering Lab., East Kilbride (UK)). 1981. Translation source information not available . 13p. NTIS (US Sales Only), PC A02. File Number DE85900529.

Tank tests have been conducted with the National Engineering Lab model bottom configuration. The output improvements results obtained are presented. Data given include the wave period dependent energy as a function of absorption efficiency for various structures, specific pressure of wave height as a function of wave frequency, mooring force, bottom plate efficiency, and efficiency of wave energy absorption. (LEW)

17 WIND ENERGY

1706 Wind Energy Engineering

11063 **(DOE/RA/50292—T2) Investigation of doubly-fed machine in variable speed application.** (Westinghouse Electric Corp., Pittsburgh, PA (USA)). 1984. Contract AC02-81RA50292. 29p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85004378.

Westinghouse has fully implemented its digital control system with the exception of the coordinate transformation function. The 500 HP test program at Westinghouse PEDS has successfu'ly concluded and the equipment has been returned to Westinghouse AESD for modifications. NASA and Westinghouse have jointly established the control modes for the MOD-0 test program. The test window available is the period 2/1/85 through 6/1/85. NASA and Westinghouse personnel have conducted two interface meetings to date with a third meeting scheduled in early December. The interfaces identified to date are straightforward. Westinghouse is modifying the control system software to provide a test operator friendly system. The goal, which is driven by funding constraints is to have NASA personnel capable of continuing test operations without Westinghouse on site after the five weeks of Westinghouse test time have been exhausted. Once the MOD-0 wind turbine has been modified to include the Westinghouse variable speed system and the system is operational, a demonstration will be conducted.

11064 **Darrieus rotor with forward tilting blade speed control.** Loth, J.L. (West Virginia Univ., Morgantown). *Solar Engineering Magazine;* 590-595(1983). Contract FG02-80CS89001.

20 ELECTRIC POWER ENGINEERING

2001 Power Plants And Power Generation

REFER ALSO TO CITATION(S) 20010010877, 11244, 11244, 11315

11065 **(DOE/ET/29040—1) Coordinated decentralized emergency operating state control.** (General Electric Co., Schenectady, NY (USA). Electric Utility Systems Engineering Dept.). Nov 1983. Contract AC01-79ET29040. 114p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number TI85003571.

Interconnected electric energy systems are frequently subjected to equipment outages and disturbances that test the ability of the system to maintain reliable service. In most instances, these outages and disturbances are readily managed by system protective equipment, control actions, and the engineered strength of the system. However, severe conditions brought about by multiple outages, generating capacity limitations or erroneous response to a disturbance can put the system in an emergency state. The objective of this work has been to develop control methodologies which through appropriate coordination would result in improved capability of the system to respond to viability crises. The primary control objective, broadly stated, is to avoid cascading outages and system collapse. Secondary objectives include minimizing the interruption of service to customers, avoiding separation of the system into islands, and minimizing the changes in generation and interchange from scheduled values. However, all of these actions may be necessary to satisfy the primary objective. It is anticipated that the control methods developed will be useful both as preventive actions in the alert state and as corrective actions in the emergency state.

11066 **(EPRI-EL—3775) Proceedings: parallel processing for power system planning and operations.** Lamont, J. (Electric Power Research Inst., Palo Alto, CA (USA)). Nov 1984. 296p. (CONF-8010378—). Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $25.00. File Number TI85920130.

From Parallel processing for power system planning and operations seminar; Dallas, TX, USA (20 Oct 1980).

This seminar provides engineers and selected researchers with an overview of parallel processing and current activities relating to the electric power industry. Power system planning and operations applications compose the vast majority of these activities. Experience of various users and EPRI activities thus far are presented. Two computer vendors made technical presentations and demonstrated their products during this seminar.

11067 **(KTM/E-D—52) Competitivity of gas-driven diesel power plants.** (Kauppa- ja Teollisuusministerio, Helsinki (Finland)). 1984. 86p. (In Finnish). Kauppa- ja Teollisuusministerio, Helsinki, Finland.

This study deals with the economics of a low calorific value gas-driven diesel power plant. Environmental aspects and siting of diesel power plants in communities and in industry are also examined. The working principle of the plant is this: solid fuel is gasified in the Pyroflow-circulating fluidized bed gasifier. The gas is then used as fuel for the Waertsilae SEMT Pielstick engine. The study includes plants with diesel engines that have 6, 12, 18, 2 x 18 and 4 x 18 cylinders. The output range is from 2.3/2.9 MW/SUB/e/MW/SUB/t to 28.0/35.1MW/SUB/t. The diesel power plants use milled peat, wood chips and in some cases also natural gas. The cost of produced electric power has been estimated and then compared with the power produced in condensing power plants. The results show that only the largest diesel power plants, 1-4 x 18 cyl. are competitive with 200 MW and 2 x 200 MW peat- and coal-fired condensing power plants. The largest plant is also competitive with a 2 x 500 MW coal-fired condensing power plant. Diesel power plants which are planned for natural gas are slightly more economical. Feasibility studies have been made where diesel power plants are sited in actual situations with electric and heat demands in five communities. They are compared with alternative ways of purchasing electric power and heat. It turns out that only the largest plant which uses gasified peat is profitable. The total potential for construction in Finland is narrowed by the high energy production costs in diesel power plants. Diesel power plants using natural gas could be economically feasible if the fuel price were lower than todays's price in Finland. (In Finnish)

11068 **Transient, steady state and stability behavior of a thermosyphon with throughflow.** Mertol, A.; Greif, R.; Zvirin, Y. (Lawrence Berkeley Lab., CA). *International Journal of Heat and Mass Transfer;* **24**: No. 4, 621-633(1981). Contract W-7405-ENG-48.

A study has been made of the flow, heat transfer and stability of a natural convection loop when there is an addition and withdrawal of fluid. The loop is a toroid that is oriented in a vertical plane and is heated over the lower half and cooled, by maintaining a constant wall temperature on the upper half. The results include stable as well as unstable configurations and also reveal multiple solutions.

2002 Environmental Aspects

REFER ALSO TO CITATION(S) 20020010864, 10865, 10866, 10868, 10869, 10870, 10876

2003 Power Transmission And Distribution

REFER ALSO TO CITATION(S) 20030011048, 11065

11069 **(BNL—51818) Superconducting power transmission system development. Cable insulation development. Semi-annual report, 1 October 1983-31 March 1984.** (Brookhaven National Lab., Upton, NY (USA)). 12 Jul 1984. Contract AC02-76CH00016. 61p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85005637.

The objective of the program is to develop an underground superconducting power transmission system which is economical and technically attractive to the utility industry. The system would be capable of carrying very large blocks of electric power, thus enabling it to supplant overhead lines in urban and suburban areas and regions of natural beauty. The program consisted initially of work in the laboratory to develop suitable materials, cryostats and cable concepts. The materials work covers the development and testing of suitable superconductors and dielectric insulation. The laboratory work has now been extended to an outside test facility which represents an intermediate step between the laboratory scale and a full-scale system. The facility allows cables several hundred feet long to be tested under realistic conditions. Five operating runs of 2 to 3 weeks duration each have been accomplished. The 60 Hz steady state performance of the cables under rated conditions have been thoroughly explored. Over voltage endurance tests and emergency level current tests have been made. Refrigeration failure under full rated current has been simulated. The system has operated for a continuous period of 57 hours at full rated power (333 MVA per cable), much of this in an unattended mode with only computer monitoring.

11070 **(DOE/RA/50158—1) Evaluation of underground dc transmission systems. Final report.** Heyer, S.V. (Philadelphia Electric Co., PA (USA). Engineering and Research Dept.). Oct 1983. Contract AC05-80RA50158. 279p. NTIS, PC A13/MF A01; 1; GPO Dep. File Number DE85002898.

This study was funded by the Electric Energy Systems Division of the US Department of Energy. It compares costs of several long underground dc cable transmission systems with an aerial dc transmission system, as well as with an underground and an aerial ac transmission system. Three different line lengths and three different ratings were studied so that the sensitivity of costs to route length and ampacity could be identified.

11071 **Critical review of external network modelling for online security analysis.** Wu, F.F.; Monticelli, A. (Univ. of California, Berkeley). *International Journal of Electrical Power and Energy Systems;* **5**: No. 4, 222-235(Oct 1983). Contract AC01-79ET29364;AC01-82CE76221.

A critical review of various external network modelling methods for online security analysis is presented. Motivations and derivations of the methods are discussed. Each method is assessed from the point of view of accuracy and of computational and load-flow compatibility. A unified approach to external network modelling which encompasses the desired features of different methods is proposed.

11072 **Numerical model to simulate the processing of electrical distribution cables. Part II. Curing rates.** Phillips, P.J.; Kodres, C.A. (Univ. of Utah, Salt Lake City). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electrical Insulation;* **EI-16**: No. 6, 490-495(Dec 1981). Contract AC02-79ER10421.

A numerical model is developed to simulate the curing and quenching of electrical distribution cables. The model considers a moving cable with possible three-dimensional variations in properties and boundary conditions. An exponential decomposition of the cross-linking agent is assumed; decomposition is then expanded in a Taylor's series to provide a means of continuously updating the progress of cross-linking. The variables of curing are analyzed by examining both a laboratory scale and a full-size facility. With the larger cables, cross-linking may continue well into the quenching stage. Hydrogen abstraction from absorbed water molecules, a potential competing reaction, apparently is insignificant.

11073 **Structure preserving model for power system stability analysis.** Bergen, A.R.; Hill, D.J. (Univ. of California, Berkeley). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Power Apparatus and Systems;* **PAS-100**: No. 1, 282-291(Jan 1981). Contract AS01-77ET29136.

A new model for the study of power system stability via Lyapunov functions is proposed. The key feature of the model is an assumption of frequency-dependent load power, rather than the usual impedance loads which are subsequently absorbed into a re-

duced network. The original network topology is explicitly represented. This approach has the important advantage of rigorously accounting for real power loads in the Lyapunov functions. This compares favorably with existing methods involving approximations to allow for the significant transfer conductances in reduced network models. The preservation of network topology can be exploited in stability analysis, with the concepts of critical and vulnerable cutsets playing central roles in dynamic and transient stability evaluation respectively. Of fundamental importance is the feature that the Lyapunov functions give a true representation of the spatial distribution of stored energy in the system.

21 NUCLEAR POWER PLANTS

11074 **(DOE/EIA—0438(84)) Commercial Nuclear Power 1984: prospects for the United States and the World.** Gielecki, M.; Diedrich, R.; Hewlett, J.; Murphy, T. (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). 27 Nov 1984. 115p. NTIS, PC A06/MF A01; 1 - GPO; GPO Dep. File Number DE85004323.

This analysis report presents the current status and outlook for commercial nuclear power reactors for all countries in the world outside centrally planned economic areas (WOCA). The report provides documentation of the US nuclear capacity and generation projections through 1995 that are presented in the Annual Energy Outlook 1983. Additionally, US nuclear capacity and generation projections through 2020 are presented for various nuclear power supply scenarios. These long-term projections are provided in support of the Department of Energy's activities pertaining to the Nuclear Waste Policy Act of 1982. The projections for foreign nuclear capacity through 1990 supplant the preliminary foreign WOCA projection presented in the Annual Energy Outlook 1983 and are supplemented by WOCA country-specific projections through 2000.

11075 **(GAO/RCED—84-186) Funding of generic activities within DOE's Office of Assistant Secretary for Nuclear Energy.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 31 Aug 1984. 18p. US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760. File Number TI85900445.

This letter contains information concerning the practice of funding generic activities from various nuclear programs; DOE internal regulations and congressional guidelines governing the funding of generic activities; the impact of funding generic activities on DOE's accounting records; and the extent to which generic activities should be disclosed in the budget process.

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

REFER ALSO TO CITATION(S) 21010011099, 11101, 11102, 11107, 11118, 11125, 11131, 11138, 11158, 11160, 11161, 11164, 11166, 11167, 11173, 11174, 11175

11076 **(CONF-801045—2) Estimating common cause failure rates for pumps in nuclear reactors.** Atwood, C.L. (EG and G Idaho, Inc., Idaho Falls (USA)). 1980. Contract AC07-76ID01570. 30p. NTIS, PC A03/MF A01. File Number TI85004730.

From DOE statistical symposium; Berkeley, CA, USA (29 Oct 1980).

Common cause fault rates are estimated for certain pumps in US commercial nuclear reactors, based on Licensee Event Reports from January 1972 through April 1978. Vesely's binomial failure rate model is used, with the methodology of Atwood (1980, NUREG/CR-1401). Issues discussed include correct classification of reported events as common cause or not, proper grouping of the pumps into common cause systems, outlier detection, and checking the adequacy of the model. Reasons are given for preferring Bayesian to classical methods for this application.

11077 **(EPRI-NP—3684-SR-Vol.2) Proceedings: second seminar on countermeasures for pipe cracking in BWRs. Volume 2. Remedy development.** (Electric Power Research Inst., Palo Alto, CA (USA)). Sep 1984. 699p. (CONF-8311208—Vol.2). Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $50.50. File Number TI85920099.

From 2. seminar on countermeasures for pipe cracking in BWRs; Palo Alto, CA, USA (15 Nov 1983).

The second seminar on countermeasures for BWR pipe cracking was held late in 1983 in Palo Alto, California. The results of nearly four years of R and D on pipe cracking, jointly sponsored by the BWR Owners Group and EPRI, were presented. Some 60 papers were delivered by organizations within the United States and overseas. The significance of this program to the utility is the development, qualification, and implementation of a large of a large number of countermeasures for the problems of pipe cracking in BWRs. Countermeasures are available for both operating plants and plants under construction. In particular, the Japanese papers demonstrated the success of the countermeasures with several years of crack-free operation in a number of BWRs. The report is published in three volumes corresponding to the three divisions of the seminar: Volume 1: Problem Resolution; Volume 2: Remedy Development; and Volume 3: Remedy Application. Volume 1 includes a list of authors of the written reports submitted and the agenda of the four-day meeting. The first seminar was held early in 1980. It was devoted to earlier work and the delineation of the program for the succeeding work, which is now reported. That seminar was reported in EPRI WS-79-174-LD, May 1980.

11078 (KFK—3777, pp 3-28) **Economic consequences of QA and QC in fuel and fuel assembly production.** Strasser, A.A. Jul 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85750267. (CONF-840326—).

From Seminar on practical experience in the application of quality control in water reactor fuel fabrication; Karlsruhe, F.R. Germany (12 Mar 1984).

The planning of quality control and quality assurance programs for fuel fabrication must balance the cost of the programs, their effectiveness, and the economic consequences of failure to meet the product specifications. The cost of fuel failures can be very high in comparison to the cost of quality control, and this provides considerable economic justification for increasing the level of quality control if its effectiveness in reducing failure potential can be demonstrated. Typical costs and examples are discussed.

11079 (KFK—3777, pp 29-46) **Technology and performance of water reactor fuel.** Rybalchenko, I.L. Jul 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85750267. (CONF-840326—).

From Seminar on practical experience in the application of quality control in water reactor fuel fabrication; Karlsruhe, F.R. Germany (12 Mar 1984).

Nuclear power proved to be a reliable and economically advantageous source of energy. Many countries are developing nuclear power programmes. Development of nuclear fuel cycle technology is an important part of each programme. The paper reviews briefly some aspects of nuclear fuel cycle developments in the world with emphasis on water reactor fuel technology and performance and quality assurance and quality control programmes. Strict QA and QC procedures have contributed significantly to the high reliability of nuclear fuel. As more R and D work is being done on improvements in fuel utilization and as more manufacturers are entering the fuel suppliers group, additional efforts are needed in standardization of fuel fabrication technology, fuel itself and quality control programmes. All this could be achieved through extensive cooperation on a multinational basis. The IAEA plays an important role in international exchange of information and cooperation. The paper gives a review of IAEA activities and future programmes in this area.

11080 (KFK—3777, pp 49-59) **Role of the governmental authority in LWR fuel fabrication QA activities in Brazil.** Pollis, R. Jul 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85750267. (CONF-840326—).

From Seminar on practical experience in the application of quality control in water reactor fuel fabrication; Karlsruhe, F.R. Germany (12 Mar 1984).

The paper deals with the position of CNEN, the Brazilian nuclear regulatory body, concerning QA in the manufacture of LWR fuel elements. As QA regulation, CNEN has adopted the IAEA's Code of Practice No.50-C-QA. A new regulation based on this code, but somewhat modified to fit Brazilian specific conditions has been developed. The activities conducted by CNEN on the fuel manufacturer are discussed. These activities include review and assessment of the QA Programme for compliance with regulatory requirements, and inspections/audits to verify the correct implementation of the measures described in the QA Programme.

11081 (KFK—3777, pp 173-194) **Statistical methods in the quality control of UO_2 pellets and Zircaloy cladding tubes for water-reactor fuel rods.** Assmann, H.; Steinberg, E. Jul 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85750267. (CONF-840326—).

From Seminar on practical experience in the application of quality control in water reactor fuel fabrication; Karlsruhe, F.R. Germany (12 Mar 1984).

Statistical methods, based on random sampling, provide effective tools for the quality control in water-reactor fuel fabrication. This paper first presents a survey of major procedures for evaluating quality control data by distribution functions, their parameters and confidence regions as well as the testing of hypotheses on a given significance level. The practical application of those statistical methods is demonstrated by examples for diameter and moisture content of UO_2 pellets and for oxygen content, hydrogen content and elevated temperature yield stress of Zircaloy cladding tubes. These examples show that a high and stable quality level can be secured by systematic product control, process control and control of testing techniques on a statistical basis.

11082 (KFK—3777, pp 249-276) **QA/QC for nuclear fuel fabrication at ASEA-Atom, Sweden.** Santen, A. van. Jul 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85750267. (CONF-840326—).

From Seminar on practical experience in the application of quality control in water reactor fuel fabrication; Karlsruhe, F.R. Germany (12 Mar 1984).

This paper describes the ASEA-ATOM system for quality assurance and quality control for manufacturing of nuclear fuel. The system is basically organized in accordance with the requirements stipulated in US NRC 10 CFR 50, Appendix B. Some examples are given to illustrate how these basic requirements are applied in practice. The QA/QC organization, some specific inspection methods and the machines used are described briefly. A general trend in inspection methods is increased automation and computerization, which minimizes inspection error and improves productivity.

11083 (KFK—3777, pp 353-364) **Fabrication and quality control of mixed oxide LWR fuel with regard to homogeneity of fissile content.** Gruber, K.; Latzel, G.; Roepenack, H. Jul 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85750267. (CONF-840326—).

From Seminar on practical experience in the application of quality control in water reactor fuel fabrication; Karlsruhe, F.R. Germany (12 Mar 1984).

Introducing this new technique some quality characteristics were found which were unknown at that time. Improvements of the test methods and analysis of test results lead to modifications within the production process which is now well under control.

11084 (KFK—3777, pp 407-414) **Methods for QC fuel assemblies.** Dressler, G.; Hetzler, F. Jul 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85750267. (CONF-840326—).

From Seminar on practical experience in the application of quality control in water reactor fuel fabrication; Karlsruhe, F.R. Germany (12 Mar 1984).

The QC of a fuel assembly may consist of more than 100,000 individual attribute measurements to produce the necessary number of approved fuel pins to make up a completed assembly. A "skeleton", made up of spacers, tie plates and tie rods or control rod guide tubes is required to provide the critical geometric positioning of the fuel rods. The "skeleton" is critical to fix each rod in a precise predetermined 3-dimensional position within a reactor core and maintain that position during a service life where the rod will be subjected to severe conditions of thermal and hydraulic forces.

11085 (KFK—3777, pp 431-453) **Chemical assay as an element of quality control of light water fuels.** Mainka, E. Jul 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85750267. (CONF-840326—).

From Seminar on practical experience in the application of quality control in water reactor fuel fabrication; Karlsruhe, F.R. Germany (12 Mar 1984).

A review will be presented of the various analytical techniques applied to the quality control of light water reactor fuels. The status of development of these methods has well advanced. Novel analytical methods now being introduced must be compared with existing performance data. The minimization of costs and wastes should play a role by selecting one of the available method.

11086 (KFK—3777, pp 469-475) **Measurement of the inner pressure of a fuel rod and determination of the filling gas purity.** Wachtendonk, H.J. von; Ebbinghaus, W. Jul 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85750267. (CONF-840326—).

From Seminar on practical experience in the application of quality control in water reactor fuel fabrication; Karlsruhe, F.R. Germany (12 Mar 1984).

Fuel rods have to be controlled for their inner pressure and for the purity of the filled helium gas. This happens on the one hand during production, but on the other hand it las to be ensured that the specified parameters are met at the final fuel rod. This can only be achieved by destructive means - re-opening of the welded fuel rod and measuring the inner pressure and analysing the helium gas contained. In this paper a simple method is presented which allows both measurements within a short time.

11087 (KFK—3777, pp 505-524) **Performance-related characteristics of water reactor fuel - an update.** Deramaix, P.; Bairiot, H. Jul 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85750267. (CONF-840326—).

From Seminar on practical experience in the application of quality control in water reactor fuel fabrication; Karlsruhe, F.R. Germany (12 Mar 1984).

Various manufacturing techniques are utilized to fabricate fuel rods, giving different characteristics to the fuel and a different response to irradiation duties. Additional differences arise from design traditions specific to each fuel vendor. On the ground of an appropriate data base complemented by proper modelling, equivalent quality can be obtained from all these fuel types and fuel rod designs. The paper discusses the particular aspects linked to the fuel structure as obtained by various conversion processes and the utilization of various specifications of Zircaloy cladding. The fuel assemblies vary not so much by the manufacturing technique as by the design itself. The various aspects related to the quality of the fuel assemblies are reviewed hereafter. Finally, considerations are given on quality-related aspects of fuel management at the site of the power plant, respectively from the point of view of handling, in-core fuel management and spent fuel storage.

11088 (NUREG/CR—3746-Vol.1) **LWR Pressure Vessel Surveillance Dosimetry Improvement Program. Semiannual progress report, October 1983-March 1984. Volume 1.** Lippincott, E.P.; McElroy, W.N. (Hanford Engineering Development Lab., Richland, WA (USA)). Nov 1984. Contract AC06-76FF02170. 202p. (HEDL-TME—84-20-Vol.1). NTIS, PC A10/MF A01 - GPO $6.00. File Number TI85003254.

Research activities conducted by the Hanford Engineering Development Laboratory, the Oak Ridge National Laboratory, and Rockwell International are reviewed concerning LWR pressure vessel surveillance dosimetry. Topics discussed include: solid-state track recorder fission rate measurements at the PCA; embrittlement of compression specimens irradiated in the SSC-1 and SSC-2 capsules of the PSF experiment; nondestructive determination of reactor pressure vessel neutron exposure; characterization of gamma-ray

spectra and energy deposition in LWR pressure vessels; calculated activities and spectral fluences for the PSF two-year irradiation experiment; power distribution calculations for the VENUS PWR mockup; SDMF irradiation experiment; Charpy test results in the ORR-PSF metallurgical irradiation experiment; and application of helium fluence monitors to LWS surveillance.

11089 Decontamination pays off for nuke owners. Smock, R. *Electric Light and Power;* **62**: No. 11, 42-44(Nov 1984).

As radiation levels build up in aging reactors, decontamination is rapidly becoming a routine maintenance procedure. The industry is coping with the problem with improved technology and with the support by the Nuclear Regulatory Commission. Decontamination of subsystems does not require public hearings or special licenses. Dilute chemical solvents remove radioactive deposits while lessening the problems of corrosion and waste disposal. Utility representatives shared experiences at a conference with decontamination of both light water and pressurized water reactors. They agreed that the next step should be full primary coolant system decontamination to improve savings even more. 1 figure, 2 tables.

2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

REFER ALSO TO CITATION(S) 21020011076, 11078, 11079, 11080, 11081, 11082, 11083, 11084, 11085, 11086, 11087, 11088, 11089, 11125, 11131, 11139, 11144, 11148, 11153, 11160, 11161, 11163, 11164, 11165, 11167, 11172, 11173, 11174, 11175

11090 (CONF-801163—1) High temperature, high pressure water level sensor. Miller, G.N.; Anderson, R.L.; Lynnworth, L.C. (Oak Ridge National Lab., TN (USA); Panametrics, Inc., Waltham, MA (USA)). 1980. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01. File Number TI85004517.

From IEEE ultrasonics symposium; Boston, MA, USA (5 Nov 1980).

A sensor was developed to measure water level over a range of 750 mm with an uncertainty of +- 20 mm at a temperature from 20 to 250°C and pressure up to 15.2 MPa. The sensor is type 304, flattened stainless steel rod. Its cross section is 1.6 x 3.2 mm, and its measured torsional transit time is a function of water density rho, level L, and temperature T. To minimize the influence of T, the extensional transit time is also measured in the same sensor. To interrogate the sensor with both modes, Joule and Wiedemann transducers are multiplexed in an alternating sequence. Experimental results, problems, and remedies are discussed.

11091 (CONF-811042—7) BWR stability monitoring using neutron noise. Upadhyaya, B.R.; March-Leuba, J. (Tennessee Univ., Knoxville (USA). Dept. of Nuclear Engineering). 1981. Contract AC05-84OR21400. 20p. NTIS, PC A02/MF A01. File Number TI85004510.

From 9. water reactor safety research information meeting; Washington, DC, USA (26 Oct 1981).

Three aspects of BWR stability have been studied in this analysis: overall core stability monitoring using neutron noise; the temporal behavior of the neutron noise signal; and relationship between stability and two-phase flow velocity. The following are the results of our analysis of BWR stability and neutron noise behavior using data from an operating reactor: the APRM noise signal can be used to monitor changes in the closed-loop stability of BWRs. Studies are currently underway to improve the estimate of stability margin by identifying the primary perturbation source. Comparison of the temporal behavior of the neutron signal for short and long data records indicates that there is no smoothing of the spectral resonance frequency nor subsequent distortion of the decay ratio when long data records were used. A positive correlation coefficient of 0.77 exists between stability index and two-phase velocity in a fuel channel. The methods developed provide an efficient procedure for on-line monitoring of stability trends in BWRs and for assessing the effects of various operating conditions during power generation and reactor maneuvering.

11092 (CTA-IEAV-NT—010/83) Moderization of the LEOPARD library. Claro, L.H.; Cunha Menezes Filho, A. da. (Centro Tecnico Aeroespacial, Sao Jose dos Campos (Brazil). Inst. de Estudos Avancados). Jul 1983. 26p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. File Number DE84703446.

The LEOPARD library is updated and tested for typical PWR unit cells with enrichment ranging from 1.0 to 4.0% and H_2O:U ratio varying from 1.0 to 10.0. A reasonably good agreement with experimental values for some spectral indices is obtained if the fission cross section of U-235 is reduced by .6% in the thermal range and by 20% in the epithermal range; the epithermal capture cross section for U-238 is increased by about 20% and the number of neutrons per fission in the thermal range of U-235 is increased by .8%.

11093 (EGG-M—16284) Primary coolant pump measurement for ICC trend analysis. Arave, A.E.; Adams, J.P. (EG and G Idaho, Inc., Idaho Falls (USA)). 1984. Contract AC07-76ID01570. 8p. (CONF-841122—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004893.

From Symposium on new technologies in nuclear power plant instrumentation and control; Washington, DC, USA (28 Nov 1984).

Reactor coolant pump motor power and temperature measurements are used by Babcock & Wilcock (B & W) plant owners to calculate void fraction for trending ICC conditions while the pumps are running. This new measurement technology satisfies NUREG 0737, Item II.F.2, "...licensees shall provide...additional instrumentation...to supplement existing instrumentation in order to provide a unambiguous, easy-to-interpret indication of inadequate core cooling. System accuracy, capability, and limitations are compared to measurement requirements using small break test data and full scale plant analytical studies. Small break experimental data shows that ICC void fraction calculations are conservative compared to gamma densitometer void fraction measurements in the pipe just upstream of the pumps and liquid level conductivity probes in the reactor vessel. Analytical studies verify that a measure of void fraction at the pumps is conservative relative to the desired coolant inventory trend conditions in the reactor vessel.

11094 (EGG-M—22484) Thermocouple modeling. Fryer, M.O. (EG and G Idaho, Inc., Idaho Falls (USA)). 1984. Contract AC07-76ID01570. 8p. (CONF-841115—7). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005172.

From International conference on power plant simulation; Mexico City, Mexico (19 Nov 1984).

The temperature measurements provided by thermocouples (TCs) are important for the operation of pressurized water reactors. During severe inadequate core cooling incidents, extreme temperatures may cause type K thermocouples (TCs) used for core exit temperature monitoring to perform poorly. A model of TC electrical behavior has been developed to determine how TCs react under extreme temperatures. The model predicts the voltage output of the TC and its impedance. A series of experiments were conducted on a length of type K thermocouple to validate the model. Impedance was measured at several temperatures between 22°C and 1100°C and at frequencies between dc and 10 MHz. The model was able to accurately predict impedance over this wide range of conditions. The average percentage difference between experimental data and the model was less than 6.5%. Experimental accuracy was +-2.5%. There is a sriking difference between impedance versus frequency plots at 300°C and at higher temperatures. This may be useful in validating TC data during accident conditions.

11095 (EPRI-NP—3574-SR) Workshop proceedings: pitting in steam generator tubing. Angwin, M.J. (ed.). (Electric Power Research Inst., Palo Alto, CA (USA)). Oct 1984. 321p. (CONF-8210321—Summs.). Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $26.50. File Number TI85920098.

From Workshop on pitting in steam generator tubing; Pittsburgh, PA, USA (28 Oct 1982).

Two utilities have experienced extensive pitting in their steam generators, and this pitting apparently arose over a relatively short (1-year) period of time. This workshop proceedings provides

an interim report on the probable causes of such pitting and the best remedial methods available. The subject areas included: pitting in operating steam generators, pit simulation in the laboratory, nondestructive evaluation, chemical cleaning, and remedial methods.

11096 **(EPRI-NP—3703) Evaluation of alternative alloys for PWR steam generator tubing. Final report.** Nelson, J.L.; Floreen, S. (INCO Alloy Products Co. Research Center, Inc., Suffern, NY (USA)). Oct 1984. 152p. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303. File Number TI85920104.

This final report summarizes the results of a project to evaluate alternative alloys for use as PWR steam generator tubing. A literature survey identified alloys 690 and 800 in the mill annealed condition and alloys 600 and 690 after annealing at 705°C (1300°F) for 15 hours as candidate alloys. Mill annealed alloy 600 was included as a control. C-ring tests were carried out in four secondary and one primary water environment. In the mill annealed condition, alloy 800 was more resistant to stress corrosion cracking than alloys 600 and 690. A low temperature anneal at 705°C (1300°F) improved the stress corrosion resistance of all the alloys. The greatest improvement was noted in alloy 690 where no failures were observed in any of the specimens even after annealing for only 4 hours. A test technique was developed to examine the stress corrosion behavior of a material by slowly internally pressurizing a section of tubing while the exterior was exposed to a simulated steam generator environment. Cracking of all alloys tested could be initiated in less than 20 days. The results indicate that alloy 600 and alloy 690 given a low temperature anneal at 705°C (1300°F) for 15 hours are more resistant to stress corrosion cracking than either mill annealed alloy 600 or mill annealed alloy 800. The degree of susceptibility of an alloy in this type of test may be dependent on pressurization rate.

11097 **(EPRI-NP—3718) Generation and behavior of metal oxide colloids in PWR steam systems.** Varsanik, R.G. (Calgon Corp., Pittsburgh, PA (USA)). Oct 1984. 64p. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303 $10.00. File Number TI85920145.

This work reviews the curently available literature and research work on the generation and behavior of metal oxide colloids in PWR steam systems. The work of E. Matijevic et al on the generation and adhesion of iron and copper oxides is described. The role of colloid chemistry in the control of plant sludge and corrosion products is described. Factors affecting the adherence and reentrainment of colloidal metal oxides along with possible methods for the control of metal oxide deposition are reviewed.

11098 **(GKSS—84/E/22) Energy-supply-independent after-heat removal in nuclear propulsion plants for ships in combination with sinking and cantering.** Finke, G. (Hannover Univ. (Germany, F.R.). Fakultaet fuer Maschinenwesen; GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1984. 186p. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE85750276.

With 66 figs., 6 tabs.

The energy-supply-independent after-heat-removal in nuclear propulsion plants for ships in combination with sinking and cantering are analysed with a numeric simulation model. Inclination on the seaground are $< 90°$ to the vertical. Different heat-transfer-mechanism in and out of the reactor vessel and at the structures of the containment are analysed. The computer calculation shows that in the course of the accident melting of the core at each inclination occurs. Nevertheless no melting of the reactor vessel occurs due to good cooling of the outer wall of the vessel with seawater.

11099 **(KFK—3777) Practical experience in the application of quality control in water-reactor fuel fabrication.** Vollath, D. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Material- und Festkoerperforschung). Jul 1984. 569p. (CONF-840326—). NTIS (US Sales Only), PC A24/MF A01. File Number DE85750267.

From Seminar on practical experience in the application of quality control in water reactor fuel fabrication; Karlsruhe, F.R. Germany (12 Mar 1984).

Highly industrialized countries have gained vast experience in manufacturing water reactor fuel. Manufacturing is followed by a stringent system of quality assurance and quality control. The Seminar on Practical Experience in the Application of Quality Control in Water-Reactor Fuel Fabrication provided a forum for an exchange of information on methods and systems of quality assurance and quality control for reactor fuel. In addition, many developing countries which have started or intend to set up a nuclear fuel industry are interested in the application of quality assurance and quality control. This meeting has been preceded by two different series of conferences: the IAEA meetings 1976 in Oslo, 1978 in Prague and 1979 in Buenos Aires, and the Karlsruhe meetings on Characterization and Quality Control of Nuclear Fuel held in 1978 and 1981. Quality control and quality assurance has many different facets. Unlike the purely technical aspects, covered by the Karlsruhe conference series, the IAEA meetings always relate to a wider field of topics. They include governmental regulations and codes for practical quality assurance. This volume contains the papers presented at the seminar and a record of the discussions. Separate abstracts have been prepared for the papers.

11100 (KFK—3777, pp 75-84) **Experience with quality assurance in fuel design and manufacturing.** Holzer, R.; Nilson, F. Jul 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85750267. (CONF-840326—).

From Séminar on practical experience in the application of quality control in water reactor fuel fabrication; Karlsruhe, F.R. Germany (12 Mar 1984).

The Quality Assurance/Quality Control activities for nuclear fuel design and manufacturing described here are coordinated under a common "Quality Assurance System For Fuel Assemblies and Associated Core Components" which regulates the QA-functions of the development, design and manufacturing of fuel assemblies independent of the organizational assignment of the contributing technical groups. Some essential characteristics of the system are shown, using examples from design control, procurement, manufacturing and qualification of special processes. The experience is very good; it allowed a flexible and well controlled implementation of design and manufacturing innovations and contributed to the overall good fuel behavior.

11101 (KFK—3777, pp 139-158) **Statistical evaluation of fuel and fuel assembly production.** Ernotte, M. Jul 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85750267. (CONF-840326—).

From Seminar on practical experience in the application of quality control in water reactor fuel fabrication; Karlsruhe, F.R. Germany (12 Mar 1984).

Statistical evaluation of product characteristics and manufacturing conditions is a valuable tool to improve both the designer's and manufacturer's knowledge of fuel technology. This knowledge may in turn be used to further improve the products and processes. The types and conditions of the evaluations Fragema is commonly running are described and examples commented. Some considerations on irradiation feedback and on the quality management information system are also developed.

11102 (KFK—3777, pp 207-219) **Quality techniques implemented during the fabrication phase of additivates and barrier fuel pellets and bundles.** Coppola, C.; Valle, P. Jul 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85750267. (CONF-840326—).

From Seminar on practical experience in the application of quality control in water reactor fuel fabrication; Karlsruhe, F.R. Germany (12 Mar 1984).

New methods were developed for QC activities related to the project mainly UT test and metallographic test during the characterization of ZR tubes with and without barrier. A characterization process has been developed for additivated fuel pellets, fuel rods and segmented fuel rods, and for the whole bundles before loading into reactor.

11103 (KFK—3777, pp 221-234) **Surveillance by EDF of PWR fuel assembly fabrication.** Hochard, G.P.; Vial, N.M.; Galimberti, M.M. Jul 1984. (In French). NTIS (US Sales Only), PC A24/MF A01. File Number DE85750267. (CONF-840326—).

From Seminar on practical experience in the application of quality control in water reactor fuel fabrication; Karlsruhe, F.R. Germany (12 Mar 1984).

This paper describes the EDF's practice for quality assurance requirements, in nuclear fuel manufacturing, applicable to suppliers of water reactor fuel assemblies. It covers methods and programmes used by "Electricite De France" (E.D.F.) to verify how the quality will be obtained in the procurement, design and manufacture of fuel assemblies by contractors and their sub-contractors. In the course of the year 1984 this programme will be scheduled with informatic assistance, by the "EDF-Magestic system", increasing efficiency for corrective actions.

11104 (KFK—3777, pp 285-302) **Use of the DOM software system in quality assurance with the manufacture of fuel elements for nuclear reactors.** Engel, H.; Peuker, J.; Herrmann, E.; Hackl, H. Jul 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85750267. (CONF-840326—).

From Seminar on practical experience in the application of quality control in water reactor fuel fabrication; Karlsruhe, F.R. Germany (12 Mar 1984).

DOM is a program system for the PR 300-16 process computer with the aid of which defined objects (workpieces) are followed through the individual production and testing operations and the production and test data acquired in this way can be stored and evaluated in relation to the object. The DOM program system is a real time system, i.e., all program functions described above are available to the user at any time. This is indeed of great significance for the application of data selection and evaluations functions.

11105 (KFK—3777, pp 365-395) **Methods of quality control for Zircaloy tubing.** Weidinger, H.G.; Kunz, K.H. Jul 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85750267. (CONF-840326—).

From Seminar on practical experience in the application of quality control in water reactor fuel fabrication; Karlsruhe, F.R. Germany (12 Mar 1984).

Quality control of cladding tube production has to take care of three aspects: quality of the incoming material, process control of all steps between incoming and outcoming material, control of the final product. This paper reports, besides a consideration of the design relevant requirements, the present status of all those three aspects. It focuses specifically on the importance of and the experience with process control. Besides a systematic discussion, four examples out of the practice of cladding tube production are described: process control with respect to surface roughness, uptake of nitrogen, trex and cladding tube eccentricity and influence of process control on dimensional deviations.

11106 (KFK—3777, pp 397-406) **Computerized ultrasonic tube testing systems with special reference to the installation in tube mills for nuclear tubing of fuel fabrication facilities.** Rauscher, R.; Buken, G. Jul 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85750267. (CONF-840326—).

From Seminar on practical experience in the application of quality control in water reactor fuel fabrication; Karlsruhe, F.R. Germany (12 Mar 1984).

During the last years testing systems for high quality tubes had to offer more and more possibilities except flaw detection and dimensional measurement. These additional facilites, which are required by the tube manufacturers on one hand and the tube customers on the other hand, can be summarized in the slogan "statistics". The possibilities of a modern tube testing system in connection with digital "on-line" data processing are shown by two typical examples.

11107 (KFK—3777, pp 553-547) **Principles governing the organization of quality control in the fabrication of water reactor fuel elements.** Gorsky, V. Jul 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85750267. (CONF-840326—).

From Seminar on practical experience in the application of quality control in water reactor fuel fabrication; Karlsruhe, F.R. Germany (12 Mar 1984).

The modern commercial fabrication of fuel elements and assemblies is impossible without the complex system of the production quality management, which covers all problems of the quality management in the production of structural and fissile materials, semi-finished products, and as-fabricated fuel elements and assemblies. The quality management of the fuel elements and assemblies is carried out beginning with the branch of industry and finishing with a shop, manufacturing structural materials. The transition to more powerful reactors and the resultant substantional growth of the fuel manufacture have required the development of more elaborate and efficient means of control, suitable for the application in the automated mass line production. More rigid requirements on fuel elements and some of their parameters made it imperative to increase in some cases the measuring accuracy and to introduce a 100% control. To control the quality of the structural components and fuel elements several new installations have been designed: 1. complex tube inspection system for ultrasonic flaw detection and dimension determination; 2. ultrasonic bench for flaw detection in zirconium alloy rods; 3. high-efficiency radiometric devices for pellet density determination; 4. semi-automatic ultrasonic bench for the flaw detection in the welds of fuel elements; 5. high-efficiency radiometric device for inter-pellet gaps detection in a fuel stack; and 6. leak testers with heated vacuum inspection chambers for the leak-testing of fuel elements.

2103 Power Reactors, Non-breeding, Graphite Moderated

REFER ALSO TO CITATION(S) 21030011130

11108 **(Juel-Spez—254) Storage characteristics of spent HTR fuel elements in transport and storage containers of modular cast iron.** Duwe, R.; Mueller, H. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorwerkstoffe und Heisse Zellen). May 1984. 86p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE85750290.

For performance of the measuring programme the CASTOR-AVR container designed by GNS and the TN-AVR 2 container designed by TN have been used in order to gain operating experiences with the loading and unloading of the containers and well as with their maintenance. The temperature is measured as well as the release of activity 1) from the FE into the can no-load volume, 2) from the cans into the container and 3) from the container to the outside. The γ- and neutron dose rates are determined.

2104 Power Reactors, Non-breeding, Otherwise Moderated Or Unmoderated

11109 (KFK—3777, pp 109-120) **Quality control considerations in fuel assembly fabrication for natural uranium reactors.** Havris, C. Jul 1984. (In French). NTIS (US Sales Only), PC A24/MF A01. File Number DE85750267. (CONF-840326—).

From Seminar on practical experience in the application of quality control in water reactor fuel fabrication; Karlsruhe, F.R. Germany (12 Mar 1984).

The paper points out the experience in the fabrication and quality control of the fuel assembly. The following problems are described: the conception philosophy for "Inspection and Test Plan", the adequate plans choice for the fuel assembly quality control, the combined utilization modality of the standards for the inspection by attributes and the inspection by variables for percent defectives, the problem of the acceptable quality level and its determination, the effects of the AQL choice for the fuel quality evaluation. The results and the statistical evaluation of some data obtained

in the fuel assembly quality control are presented at the end of the paper.

11110 (KFK—3777, pp 121-137) **Experiences in the application of quality control and quality assurance programmes in water reactor fuel fabrication.** Balaramamoorthy, K.; Vijayaraghavan, R.; Kulkarni, P.G.; Raghavan, S.V.; Bandyopadhyay, A.K.; Kondal Rao, N.; Rajendran, R.; Krishnan, T.S.; Patro, J.B.; Somayajulu, G.V.S.R.K. Jul 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85750267. (CONF-840326—).

From Seminar on practical experience in the application of quality control in water reactor fuel fabrication; Karlsruhe, F.R. Germany (12 Mar 1984).

Nuclear fuel for Research Reactors and Pressurised Heavy Water Reactors (PHWRs) is being fabricated in India for a period of over two decades. The fuel is produced to conform to stringent quality control specifications. Generally, the performance of the fuel has been very good in the reactors. This is not only due to the high quality workmanship in the various stages of production but also to the meticulous care exercised in the planning and application of quality control and quality assurance procedures. For the nuclear fuel used in Water Reactors, extensive material specifications have been compiled and they are periodically reviewed and revised. The specifications cover various aspects such as metallurgical and mechanical properties, non-destructive testing, dimensional and visual standard requirements. Similarly, detailed manufacturing engineering instructions (MEIs) and quality control instructions (QCIs) have been drawn. For any deviations from the specified requirements, design concession committee considers all deviations and acceptance or rejection criteria are evolved. In this task, the design concession committee is supported by experimentation in various laboratories of the Department of Atomic Energy. The quality assurance procedures have been evolved over a long period of time. They generally conform to the latest code and recommended guides of IAEA regarding quality assurance in the manufacture of fuel.

11111 (KFK—3777, pp 159-171) **Quality control and performance of PHWR fuel in India.** Rustagi, R.S.; Das, M.; Arora, O.P. Jul 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85750267. (CONF-840326—).

From Seminar on practical experience in the application of quality control in water reactor fuel fabrication; Karlsruhe, F.R. Germany (12 Mar 1984).

Indian Nuclear Power Programme is currently based on installation of a series of pressurised heavy water reactors in 235 MWe size, followed by 500 MWe size reactors in the nineties. Indigenous facilities for nuclear fuel design, fabrication and quality auditing have been developed. Statistical quality control and 100% inspection techniques are applied for ensuring the quality of fuel. Good operating experience on fuel over the last 10 years has validated the design and quality characteristics in fuel specifications. The paper describes the different designs of PHWR fuel bundles now fabricated in India and the quality control aspects evolved. Furthermore, some typical results are brought out.

11112 (KFK—3777, pp 491-502) **Questions/problems of QA/QC personnel training and qualification in developing countries.** Balaramamoorthy, K. Jul 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85750267. (CONF-840326—).

From Seminar on practical experience in the application of quality control in water reactor fuel fabrication; Karlsruhe, F.R. Germany (12 Mar 1984).

In India, nuclear power stations are designed, constructed, commissioned, operated and owned by the Department of Atomic Energy. The Indian nuclear energy programme is based on utilization of indigenous resources for the economic generation of power. The need for self-sufficiency in nuclear fuel fabrication is imperative for a sustained nuclear power programme. Since training of scientific and technical manpower is an important activity in a developing country, a manpower training programme was initiated in India several years before the introduction of nuclear power plants. It is essential to have a very broad based planning of manpower training in all its aspects for the successful implementation of nuclear power plants. The paper deals in detail with the practices of establishing the manpower needs, training of requisite personnel, problems faced and how they were resolved. It also deals with the organizational philosophy and highlights the areas of concern for special training.

2105 Power Reactors, Breeding

REFER ALSO TO CITATION(S) 21050010966, 11155, 11156, 11164

11113 **Use of Kalman filter methods in analysis of in-pile LMFBR accident simulations.** Meek, C.C.; Doerner, R.C. (Argonne National Lab., IL). *Proceedings of the 22nd IEEE Conference on Decision & Control;* 764-767(Dec 1983).

Kalman filter methodology has been applied to inpile liquid-metal fast breeder reactor simulation experiments to obtain estimates of the fuel-clad thermal gap conductance. A transient lumped parameter model of the experiment is developed. An optimal estimate of the state vector chosen to characterize the experiment is obtained through the use of the Kalman filter. From this estimate, the fuel-clad thermal gap conductance is calculated as a function of time into the test and axial position along the length of the fuel pin.

2106 Power Reactors, Auxiliary, Mobile, Package, And Transportable

REFER ALSO TO CITATION(S) 21060011344

11114 **(NAA-SR-TDR—12511) Electron microprobe analysis of irradiated S8ER cladding.** Krupp, W.E.; Cooper, L. (Atomics International Div., Canoga Park, CA (USA)). 24 Aug 1967. 18p. NTIS, PC A02. File Number DE85004477.

Extensive precipitation was observed in S8ER cladding following irradiation. Electron microprobe analysis was proposed as a means to identify these precipitates. Subsequently, the electron microprobe was successfully used for qualitative analysis of unirradiated and irradiated S8ER cladding. The unirradiated, thermally aged control specimen analyzed showed two major precipitates. One, a randomly distributed intergranular phase, contained Ti, Mo, Fe, Cr and Ni and a second, a randomly distributed intragranular phase, contained Si, Mo, Fe, Cr and Ni. The irradiated specimen analyzed showed the same precipitates. The phase containing Ti, Mo, Fe, Cr and Ni was also randomly distributed intergranularly. The phase containing Si, Mo, Fe, Cr and Ni was in the grain boundaries, and preferentially segregated to the outer and inner diameter.

2107 Regulation And Licensing

11115 **(GAO/RCED—84-149) Management weaknesses affect Nuclear Regulatory Commission efforts to address safety issues common to nuclear power plants.** Bowsher, C.A. (General Accounting Office, Washington, DC (USA). Office of the Comptroller General). 19 Sep 1984. 59p. General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760. File Number TI85900449.

Report to The Congress.

Investigations of the March 1979 Three Mile Island nuclear plant accident showed that the Nuclear Regulatory Commission (NRC) had not made adequate progress in addressing safety issues common to nuclear plants that had been identified before that accident. GAO evaluated NRC's progress in managing these safety issues and determined that NRC has increased the rate at which it develops regulatory solutions for these issues. NRC has improved its methods for identifying safety issues and determining their importance to safety. NRC does not, however, have sufficient management controls in place to ensure resolution of issues and implementation of appropriate changes to affected nuclear plants and to NRC's regulatory procedures in a timely manner. GAO makes several recommendations pertaining to the need for improved management controls. GAO also presents a matter for consideration by the Congress which would result in improved public disclosure by NRC of its progress in addressing the most important of these safety issues.

11116 **(NUREG—0748-Vol.4-No.10) Operating reactors licensing actions summary. Vol. 4, No. 10.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Resource Management). Nov 1984. 307p. NTIS, PC A14/MF A01 - GPO*. File Number TI85900851.

This document is designed to provide the management of the Nuclear Regulatory Commission (NRC) with an overview of licensing actions dealing with operating power and nonpower reactors. This summary report is published primarily for internal NRC use in managing the operating reactors licensing actions program.

11117 **(NUREG—0748-Vol.4-No.11) Operating reactors licensing actions summary. Volume 4, No. 11.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Resource Management). Dec 1984. 303p. NTIS, PC A14/MF A01 - GPO*. File Number TI85900679.

This document is designed to provide the management of the Nuclear Regulatory Commission (NRC) with an overview of licensing actions dealing with operating power and nonpower reactors. These reports utilize data collected from the Division of Licensing in the Office of Nuclear Reactor Regulation and are prepared by the Office of Resource Management.

11118 **(NUREG—0934) Technical specifications Grand Gulf Nuclear Station, Unit No. 1 (Docket No. 50-416). Appendix A to License No. NPF-29.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Oct 1984. 535p. NTIS, PC A23/MF A01 - GPO* $10.00. File Number TI85900355.

Specifications for Grand Gulf-1 reactor are presented concerning limiting conditions for operation and surveillance requirements; design features; and administrative controls.

22 NUCLEAR REACTOR TECHNOLOGY

2201 Theory And Calculation

11119 **(CONF-8410170—3) KENO-V code.** Cramer, S.N. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 26p. NTIS, PC A03. File Number DE85002577.

From Monte Carlo methods in nuclear reactor analysis; Ispra, Italy (8 Oct 1984).

The KENO-V code is the current release of the Oak Ridge multigroup Monte Carlo criticality code development. The original KENO, with 16 group Hansen-Roach cross sections and P_1 scattering, was one ot the first multigroup Monte Carlo codes and it and its successors have always been a much-used research tool for criticality studies. KENO-V is able to accept large neutron cross section libraries (a 218 group set is distributed with the code) and has a general P/sub N/ scattering capability. A supergroup feature allows execution of large problems on small computers, but at the expense of increased calculation time and system input/output operations. This supergroup feature is activated automatically by the code in a manner which utilizes as much computer memory as is available. The primary purpose of KENO-V is to calculate the system k/sub eff/, from small bare critical assemblies to large reflected arrays of differing fissile and moderator elements. In this respect KENO-V neither has nor requires the many options and sophisticated biasing techniques of general Monte Carlo codes.

11120 **(CONF-8410170—4) MORSE Monte Carlo code.** Cramer, S.N. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 112p. NTIS, PC A06. File Number DE85002578.

From Monte Carlo methods in nuclear reactor analysis; Ispra, Italy (8 Oct 1984).

The MORSE code is a large general-use multigroup Monte Carlo code system. Although no claims can be made regarding its superiority in either theoretical details or Monte Carlo techniques, MORSE has been, since its inception at ORNL in the late 1960s, the most widely used Monte Carlo radiation transport code. The principal reason for this popularity is that MORSE is relatively easy to use, independent of any installation or distribution center, and it can be easily customized to fit almost any specific need. Features of the MORSE code are described.

2202 Components And Accessories

REFER ALSO TO CITATION(S) 22020011076

11121 **(AD-P—003642/6) Seismic stress fields for nuclear elbows using toroidal elasticity theory.** Lang, H.A. (Lang-Research West, Santa Monica, CA (USA)). 1984. 8p. (CONF-8404225—). NTIS, PC A02/MF A01.

From 2. international conference on recent advances in structural dynamics; Southampton, UK (9 Apr 1984).

See Volume 1, AD-A143 300, p47-54.

Toroidal elasticity, first introduced at London, England (1980) is a new tool of stress analysis. It merges a toroidal geometry with the fully three dimensional theory fo elasticity. For isotropic materials, it includes both stress and strain compatibility relations in order to ensure that the deformations are properly determined and topologically correct. Since the theory is complete, all three components of displacement, all six components of strain, and all six components of stress may be determined. The compatibility equations, though rigorously correct, are lengthy. To apply the theory to a large number of boundary value problems, the method of successive approximation has been adopted. All equations are expanded in powers of 1/R (where R is the toroidal radius). This leads to a set of working equations appropriate for the solution of problems. In the present paper the methods of toroidal elasticity are extended to the problem of determining the stress fields in a hollow circular elbow or pipe bend under the action of seismic accelerations. The seismic accelerations are represented by equivalent body forces X, Y, Z acting in arbitrary directions. The seismic forces may also be viewed as upper bounds obtained from seismic response curves.

11122 **(CONF-800747—2) Heated thermocouple liquid level system.** Anderson, J.V.; Jeffery, C.L. (EG and G Idaho, Inc., Idaho Falls (USA)). 1980. Contract AC07-76ID01570. 21p. NTIS, PC A02/MF A01. File Number TI85004724.

From Review group conference on advanced instrumentation for reactor safety research; Oak Ridge, TN, USA (29 Jul 1980).

A heated thermocouple liquid level system has been developed and tested for the Water Reactor Safety Research Programs by EG and G Idaho, Inc. at the Idaho National Engineering Laboratory. The tranducer materials are qualifiable for the long life and radiation resistant requirements of the nuclear industry. The system response with economical components has been demonstrated to be 0.1 s. This paper describes the system hardware, software, and testing. Recommendations for extending system performance and analysis to additional applications are also included.

11123 **(CONF-810621—4) Application of zone-matching methodology to interacting submerged multiport diffusers.** Eraslan, A.H.; Witten, A.J. (Tennessee Univ., Knoxville (USA). Dept. of Engineering Science and Mechanics; Oak Ridge National Lab., TN (USA)). 1981. Contract AC05-84OR21400. 19p. NTIS, PC A02/MF A01. File Number TI85004520.

From Symposium on fluid mechanics of combustion systems; Boulder, CO, USA (22 Jun 1981).

A systematic application of a zone-matching methodology is presented for simulating the plant induced flow field from interacting, submerged directional, multiport diffusers, in a coastal region with predominantly natural tidal flow. The diffuser-induced near-field flow is approximately represented as a superposition of radial jets. Each jet near-field flow is determined using a singular perturbation method so as to produce the upstream entrainment characteristic of multiport diffusers. The far-field diffuser-induced flow is determined numerically using a two-dimensional discrete element model. This flow field represents a higher order correction to the near-field flow which satisfies the no-mass flux condition on solid boundaries. Natural flows and other plant induced flows are simulated with the two-dimensional, discrete element, hydrodynamic model. An application of this methodology to a three unit nuclear power plant in southern California is given.

11124 **(KFK—3746) Parametric investigations on the retention of methyl iodide by a KI-impregnated activated carbon.** Deuber, H.; Gerlach, K. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Lab. fuer Aerosolphysik und Filtertechnik 1). Jun 1984. 68p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE85750298.

Investigations are described on the retention of methyl iodide (CH_3I-131) by a typical batch of the activated carbon 207B (KI) which is mostly used in the iodine filters of German nuclear power plants. The results obtained with variation of about ten parameters are relevant both for the testing of activated carbons and for the design, operation and surveillance of iodine filters.

2203 Fuel Elements

REFER ALSO TO CITATION(S) 22030010961, 11173

11125 **(DOE/EA—0118) Environmental assessment: DOE program to improve uranium utilization in light water reactors.** (USDOE, Washington, DC). Aug 1980. 55p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85003488.

DOE is planning to conduct a research and development program to develop and demonstrate light water reactor (LWR) fuel capable of achieving extended burnups (45,000 to 55,000 MWd/t) and to demonstrate modified fuel management schemes in which a somewhat smaller fraction of the core loading is replaced at each refueling interval and in which neutron leakage is reduced from the reactor core. This proposed action, the probable impact of the proposed action on the environment, and alternatives to the proposed action are discussed in this report. Although the proposed action is limited to the research and development (R & D) program required to develop and demonstrate alternatives for improving uranium utilization, it is expected that these improvements will be utilized in commercial pressurized water reactor (PWR) and boiling water reactor (BWR) plants, assuming the successful completion of this R & D program and review and approval by the Nuclear Regulatory Commission (NRC). The implementation of these improvements in commercial PWR and BWR plants would reduce the requirements for mining and milling of uranium ore, separative work, fuel fabrication, and spent fuel storage. A reduction in fuel cycle cost and impacts would also be obtained because of the reduction in U_3O_8, fuel fabrication, and spent fuel storage requirements. The impact of eventually implementing these improvements in commercial reactors is discussed since its implementation constitutes a probable long-term environmental effect.

11126 (KFK—3777, pp 195-205) **Continuous inspection during fabrication.** Nury, J.C.; Robin, J.P.; Foure, M.; Morin, C.; Beneden, J. van. Jul 1984. (In French). NTIS (US Sales Only), PC A24/MF A01. File Number DE85750267. (CONF-840326—).

From Seminar on practical experience in the application of quality control in water reactor fuel fabrication; Karlsruhe, F.R. Germany (12 Mar 1984).

The continuous inspection process is a method used in a manufacturing plant in order to obtain a fast feed-back between inspection results and manufacturing process. It often requires a specific approach in design and a wide cooperation between engineering and manufacturing people. This method leads to additional advantages such as high motivation and better quality knowledge.

11127 (KFK—3777, pp 455-467) **Methods and procedures of chemical analyses of zircaloy tubing.** Bowles, K. Jul 1984. NTIS (US Sales Only), PC A24/MF A01. File Number DE85750267. (CONF-840326—).

From Seminar on practical experience in the application of quality control in water reactor fuel fabrication; Karlsruhe, F.R. Germany (12 Mar 1984).

To determine conformance to the chemical composition requirements, the zircaloy ingot is sampled either in accordance with procedures outlined in ASTM B350 or as approved by the tubing manufacturer. The samples are analyzed for the alloying elements and impurities by methods and standards adopted by the manufacturer, but not necessarily those used worldwide. When possible, standards traceable to NBS are used for verification, but in most part the standards are made in-house by mixing high purity zirconium oxides or solutions with oxides or solutions of the elements of interest.

11128 **Fuel transient deformation.** Slagle, O.D.; Bard, F.E.; Gneiting, B.C.; Thielges, J.R. (Hanford Engineering Development Lab., Richland, WA (USA)). *Nuclear Engineering and Design;* 79: No. 3, 301-307(Jun 1984). (CONF-830867—; CONF-830805—).

From 7. international seminar on computational aspects of the finite element method; Chicago, IL, USA (29 Aug 1983).

Cladding strains resulting from fuel-cladding mechanical interaction in a transient tested fuel pin are assessed against laboratory measurements of high-temperature creep and hot pressing of mixed-oxide fuel pelelts. A fuel pin containing nine different fuel sections with varying fuel pellet geometry and density was transiently tested in a MARK IIIA flowing sodium loop under conditions typical of a 1S/s overpower transient. Post-test cladding strain meausrements indicated that the largest strains were generated by solid pellets with small gaps while large gap annular pellets generated the smallest strains. High-temperature creep and hot pressing tests on mixed-oxide fuel have been performed at temperatures up to 2600°C. The results indicate that at temperatures above 2300°C, an additional component of creep is operative; while the densification due to hot pressing was considerably less than expected by extrapolating the low-temperature behavior. Both the in- and out-of-reactor data suggest that fuel creep into the center void or hole of a fuel pin is a more effective means of reducing fuel-cladding stress than densification by hot pressing into fuel pellet porosity.

2204 Control Systems

11129 **(CONF-8410173—6) Blackness coefficients, effective diffusion parameters, and control rod worths for thermal reactors - methods.** Bretscher, M.M. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 11p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005058.

From International meeting on reduced enrichment for research and test reactors; Argonne, IL, USA (14 Oct 1984).

Simple diffusion theory cannot be used to evaluate control rod worths in thermal neutron reactors because of the strongly absorbing character of the control material. However, reliable control rod worths can be obtained within the framework of diffusion theory if the control material is characterized by a set of mesh-dependent effective diffusion parameters. For thin slab absorbers the effective diffusion parameters can be expressed as functions of a suitably-defined pair of blackness coefficients. Methods for calculating these blackness coefficients in the P_1, P_3, and P_5 approximations, with and without scattering, are presented. For control elements whose geometry does not permit a thin slab treatment, other methods are needed for determining the effective diffusion parameters. One such method, based on reaction rate ratios, is discussed.

2205 Environmental Aspects

11130 **(INIS-mf—8886) Analysis of fission product transport parameters in the fuel element for temperatures up to 2500°C based on heat-up experiments and their application to heat-up incidents using the PNP-500 as example.** Drescher, H.E. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Maschinenwesen). 14 Jul 1982. 189p. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE85780118.

Important predictions relating to instationary release behaviour are given, in particular with regard to the movement of caesium from the particle, via coating buffer, matrix and shell graphite through to the cooling gas. Of special note is the strong increase in activation energy of the fission product transport parameters in the temperature range above 1600°C. The calculations were applied to HTR-core heat up accidents with an intact primary cycle and with prior loss of coolant. The starting point of the calculation is the re-

actor core "history", in particular the inventory distribution, not only in the individual core areas but also over the various fuel element zones. The liberation of the noble gases iodine and caesium with temperature were calculated, the chief emphasis being given to caesium.

11131 **Aerosol instrumentation for the Marviken aerosol transport tests.** Strom, L. (Studsvik Energiteknik AB, Nykoeping (Sweden)); Makynen, J.M. (Valtion Teknillinen Tutkimuskeskus, Helsinki (Finland)); Piispanen, W. (Battelle Columbus Labs., OH (USA)). *Journal of Aerosol Science;* **15**: No. 3, 347-349(1984). (CONF-8309167—).

From Annual meeting of Association for Aerosol Research; Munich, F.R. Germany (13 Sep 1983).

Abstract of paper.

The primary purpose of the Marviken ATT (Aerosol Transport Tests) project is to create a data base from large scale facilities on the behaviour of vapours and aerosols produced from overheated core materials within typical Pressurized Water Reactor (PWR) primary systems and Boiling Water Reactor (BWR) pressure vessels. The data base is needed to verify theoretical methods which can be and are being used to predict results of postulated core melt accidents for a wide range of geometries and fluid conditions. The existing Marviken test facility has been modified to meet these objectives. The program has a second objective which is to provide a large-scale demonstration of the behaviour of aerosols in primary systems. Headings: system design; test conditions; aerosol sampling; sampling operations; observations from the first fission test.

2206 Research, Test, And Experimental Reactors

REFER ALSO TO CITATION(S) 22060011145, 11146, 11147, 11148

11132 **(CONF-801107—26) Application of ANSI/ANS-5.1-1979/HEAT5G code to LOFT technical specifications.** Hanson, G.H.; Tasaka, K.G.D.L.; Atkinson, S.A. (EG and G Idaho, Inc., Idaho Falls (USA)). 1980. Contract AC07-76ID01570. 17p. NTIS, PC A02/MF A01. File Number TI85004751.

From ANS international conference; Washington, DC, USA (17 Nov 1980).

This paper presents the solution of a LOFT nuclear safety problem which required establishing the reactor decay time, following any LOFT operation, which would safely permit the disabling of the automatic actuation of the Emergency Core Cooling System (ECCS). The special calculational tool which was developed for the solution of safety and programmatic problems is the HEAT5G Code, which establishes P/P_0 (decay power divided by operating power) for complex combinations of operating and shutdown times, using information and methods of ANSI/ANS-5.1-1979. This Decay Heat Standard makes possible significant reductions in the reactor decay cooling time requirements in the LOFT Technical Specifications. For a typical LOFT operating period of 40 hours at 50 MW full power, a 28-hour decay period (rediced from 34 hours) is required before automatic actuation of ECCS may be disabled.

11133 **(CONF-8410173—9) Neutronics study of LEU fuel options for the HFR-Petten.** Deen, J.R.; Snelgrove, J.L. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005060.

From International meeting on reduced enrichment for research and test reactors; Argonne, IL, USA (14 Oct 1984).

The standard HEU fuel cycle characteristics are compared with those of several different LEU fuel cycles in the new vessel configuration. The primary design goals were to provide similar reactivity performance and neutron flux profiles with a minimal increase in ^{235}U loading. The fuel cycle advantages of Cd burnable absorbers over ^{10}B are presented. The LEU fuel cycle requirements were calculated also for an extended 32-day cycle and for a reload batch size reduction from six to five standard elements for the standard 26-day cycle. The effects of typical in-core experiments upon neutron flux profiles and fuel loading requirements are also presented.

11134 **(CONF-8410173—11) US RERTR Program: overview, status and plans.** Travelli, A. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005047.

From International meeting on reduced enrichment for research and test reactors; Argonne, IL, USA (14 Oct 1984).

The status of the Reduced Enrichment Research and Test Reactor (RERTR) Program is reviewed. After a brief review of the accomplishments which the RERTR Program, in cooperation with its many international partners, had achieved by the end of 1983 in the area of LEU research reactor fuels development and application, emphasis is placed on the RERTR Program developments which took place during 1984 and on current plans and schedules. The RERTR progress in 1984 has been significant, with solid accomplishments and few surprises. Most LEU U_3Si_2-Al irradiation tests with 4.8 g U/cm^3 have been successfully completed, and contract negotiations are under way for the procurement of a whole-core demonstration of this fuel in the ORR. The demonstration is to begin in mid-1985 and to last for approximately eighteen months. Qualification of U_3Si_2-Al fuel with 7 g U/cm^3 is scheduled for 1989. International cooperation among fuel developers, commercial vendors, and reactor operators has been essential to the progress which has been achieved. With continued international cooperation, it will be feasible to significantly reduce HEU usage in research reactors in the next few years.

11135 (KFK—3777, pp 477-490) **LR-0 research reactor experimental fuel production control.** Vesely, P.; Drexler, J.; Fiala, B.; Bardos, J. Jul 1984. (In Russian). NTIS (US Sales Only), PC A24/MF A01. File Number DE85750267. (CONF-840326—).

From Seminar on practical experience in the application of quality control in water reactor fuel fabrication; Karlsruhe, F.R. Germany (12 Mar 1984).

VZUP - Nuclear Fuel Institute, Prague-Zbraslav, in cooperation with the Nuclear Research Institute, Rez by Prague, have designed and manufactured WWER-440-LR 0 experimental fuel assemblies. During the production the necessary control system was applied. This paper gives basic information concerning the control system used as well as the results obtained.

11136 **(ORNL/TM—9417) Bulk Shielding Facility quarterly report, April, May and June 1984.** Corbett, B.L.; Lance, E.D. (Oak Ridge National Lab., TN (USA)). Dec 1984. Contract AC05-84OR21400. 19p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85004946.

The BSR operated at an average power level of 1310 kW for 3.8% of the time during April, May, and June. Water-quality control in both the reactor primary and secondary cooling systems was satisfactory. The PCA was used in training startups and was operated on five occasions for the NBS and HEDL recheck of a previous experiment run on the LWR pressure vessel surveillance dosimetry improvement program.

2207 Plutonium And Isotope Production Reactors

11137 **(DP-MS—84-100) Simulation calculations for a catalytic exchange/cryogenic distillation hydrogen isotope separation process.** Rodman, M.; Howard, D.W. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1984. Contract AC09-76SR00001. 34p. (CONF-8411125—1). NTIS, PC A03/MF A01; GPO Dep. File Number DE85003656.

From Process simulation symposium; Wilmington, DE, USA (8 Nov 1984).

Some of the aspects of the optimization and simulation calculations for the Moderator Detritiation Plant thay may be applicable to other processes are described. The FORTRAN optimization program and the CPES and PROCESS distillation calculation are covered.

2209 Reactor Safety

REFER ALSO TO CITATION(S) 22090011077, 11095, 11113, 11115, 11130, 11608, 11610

11138 **(BNL-NUREG—28186) RAMONA-3B, a code for BWR plant transients.** Diamond, D.J.; Ruger, C.J.; Garber, D.I.; Lekach, S.V. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 11p. (CONF-810113—4). NTIS, PC A02/MF A01 - GPO. File Number TI85004835.

From Simulation methods for nuclear power systems conference; Tucson, AZ, USA (1 Jan 1981).

RAMONA-3B is a code for calculating boiling water reactor (BWR) transients. It is unique in that it can calculate the core with three-dimensional neutronics while calculating the remainder of the nuclear steam supply system (NSSS). An overview of the code is presented in which the neutronics and thermal hydraulics are summarized. Applications of the code are discussed as is the code assessment effort.

11139 **(BNL-NUREG—28738) Analysis of ex-vessel debris/water interaction and a potential overpressurization of containment.** Yang, J.W. (Brookhaven National Lab., Upton, NY (USA)). 1980. Contract AC02-76CH00016. 12p. (CONF-8010156—1). NTIS, PC A02/MF A01 - GPO. File Number TI85004736.

From Chinese-American engineering and management institute symposium on nuclear power; New York, NY, USA (12 Oct 1980).

In the event of a meltdown in a PWR in which the disrupted core materials breach the primary vessel, the hot debris will interact with water in the containment cavity. The debris-water interaction provides a rapid generation of steam, which could build up pressure beyond the containment building limit. Previous analysis of the debris-water interactions was based on the single-sphere model, in which the internal and surface heat transfer are the control mechanism. In this study, the debris-water interaction is analyzed in terms of a porous debris bed model. The debris cooling and steam generation are controlled by the hydrodynamics of the two-phase flow. Different porous models developed by Dhir-Catton and Lipinski were examined and used to test their impact on containment dynamics. The results show that the magnitude of the predicted pressure rises is not affected by the different models. The occurence of the peak pressure, however, is considerably delayed by using the porous bed model.

11140 **(CONF-801091—1) Evaluation of on-line control techniques for heater rods in the Semiscale Mod-3 system.** Shimeck, D.J.; Venhuizen, J.R. (Idaho National Engineering Lab., Idaho Falls (USA)). 1980. Contract AC07-76ID01570. 29p. NTIS, PC A03/MF A01. File Number TI85004763.

From International symposium on fuel rod simulators-development and application; Gatlinburg, TN, USA (22 Oct 1980).

An on-line control technique has been developed for use in controlling electrically heated rods in a manner that simulates the thermal behavior of nuclear rods. The computer program and associated hardware have been installed and tested in the Semiscale Mod-3 system. Data from a series of 200%, cold leg pipe break transient tests indicate that the technique is producing correct trends of core behavior and that it shows promise as a more correct and flexible control mechanism than preprogrammed power control. The tests have also provided a data base necessary for analytical efforts to verify and further improve controller response. Test results and improvements in control philosophies based on posttest investigations are quantitatively addressed.

11141 **(CONF-801091—3) Testing and analysis of the Semiscale Mod-1 heater rod design.** Larson, T.K. (Idaho National Engineering Lab., Idaho Falls (USA)). 1980. Contract AC07-76ID01570. 32p. NTIS, PC A03/MF A01 - GPO. File Number TI85004761.

From International symposium on fuel rod simulators-development and application; Gatlinburg, TN, USA (22 Oct 1980).

The use of electrically heated nuclear fuel rod simulators in the Semiscale Program is traced from a historical viewpoint. The design of the Semiscale Mod-1 electrical heater rod and core simulator is discussed. Heater rod thermal response during transient thermal-hydraulic depressurization experiments conducted in the Mod-1 system, and analysis techniques and tests conducted to help quantify heater rod characteristics and behavior are presented.

11142 **(CONF-801091—10) Review of experiments to evaluate the ability of electrical heater rods to simulate nuclear fuel rod behavior during postulated loss-of-coolant accidents in light water reactors.** McPherson, G.D.; Tolman, E.L. (Nuclear Regulatory Commission, Washington, DC (USA); EG and G Idaho, Inc., Idaho Falls (USA)). 1980. Contract AC07-76ID01570. 16p. NTIS, PC A02/MF A01. File Number TI85004723.

From International symposium on fuel rod simulators-development and application; Gatlinburg, TN, USA (22 Oct 1980).

Issues related to using electrical fuel rod simulators to simulate nuclear fuel rod behavior during postulated loss-of-coolant accident (LOCA) conditions in light water reactors are summarized. Experimental programs which will provide a data base for comparing electrical heater rod and nuclear fuel rod LOCA responses are reviewed.

11143 **(CONF-801107—38) Chemical behavior of fission product iodine following LWR accidents.** Campbell, D.O.; Malinauskas, A.P.; Stratton, W.R. (Oak Ridge National Lab., TN (USA); Los Alamos National Lab., NM (USA)). 1980. Contract AC05-84OR21400. 3p. NTIS, PC A02/MF A01. File Number TI85004518.

From ANS international conference; Washington, DC, USA (17 Nov 1980).

Hydrolysis of molecular iodine with water yields products much less volatile than the initial I_2, whereas dissolution of iodide yields a stable solution of extremely low iodine volatility. There is evidence from TMI for reducing conditions, which would stabilize iodide, in the containment water, even many months after the accident. At TMI, organic iodides are apparently the dominant volatile species and are present to the extent of about 0.01% of the core inventory of iodine; volatile inorganic species are present in negligible amounts. It is contended that iodide is the initial form of iodine in LWR accidents, and that volatile iodine species will not result to an appreciable extent from such accidents if oxidizing conditions are prevented. In the evaluation of iodine risk, it is extremely important to distinguish between (a) oxidizing or reducing conditions and (b) a wet or dry environment. Escape to the atmosphere of a significant fraction of the iodine appears to require dry and oxidizing conditions (such as occurred at Windscale).

11144 **(CONF-810113—3) Potential for interactive/real time nuclear power plant simulation with RELAP5.** Wagner, R.J.; Ransom, V.H.; Ybarrondo, L.J. (EG and G Idaho, Inc., Idaho Falls (USA)). 1981. Contract AC07-76ID01570. 14p. NTIS, PC A02. File Number DE85004752.

From Simulation methods for nuclear power systems conference; Tucson, AZ, USA (1 Jan 1981).

RELAP5 is a computer code, used to simulate transients in light water reactors and was designed primarily for large and small break loss-of-coolant and operational transients. Development emphasized fast running, ease of use, and sufficient accuracy for most calculations. Models used in RELAP5 are briefly described and applications of the code to Semiscale and LOFT experiments are illustrated. Planned research at INEL to use RELAP5 in interactive, real time, and ultimately predictive modes are discussed.

11145 **(CONF-810120—7) Hydrogen studies during PBF Severe Fuel Damage tests.** Osetek, D.J.; Hobbins, R.R.; Buescher, B.J.; Cook, B.A. (EG and G Idaho, Inc., Idaho Falls (USA)). 1981. Contract AC07-76ID01570. 14p. NTIS, PC A02/MF A01. File Number TI85004753.

From Workshop on the impact of hydrogen on water reactor safety; Albuquerque, NM, USA (26 Jan 1981).

The PBF Severe Fuel Damage tests will provide a unique opportunity to address several reactor safety issues. These experiments will simulate severe accidents which include fuel behavior similar to the TMI accident. Rod damage mechanisms, fuel rod fragmentation, rubble bed formation, hydrogen generation and fis-

sion product release are among the important phenomena which will be investigated. The on-line hydrogen measurements, supplemented with analyses of grab samples will provide data to evaluate zircaloy oxidation models and define hydrogen behavior during accidents.

11146 **(CONF-810406—8) Comparison of mass flow calculations using drag disc/turbine transducer (DTT) data from the Transient Flow Calibration Facility.** Meachum, T.R. (EG and G Idaho, Inc., Idaho Falls (USA)). 1981. Contract AC07-76ID01570. 9p. NTIS, PC A02/MF A01. File Number TI85004531.

From 27. international instrumentation symposium; Indianapolis, IN, USA (27 Apr 1981).

Several different methods of calculating mass flow using drag disc/turbine transducer (DTT) data, obtained at the Transient Flow Calibration Facility, are presented. Data obtained from the DTT rake were used in conjunction with density profiles obtained from a six-beam gamma densitometer to calculate a mass flow. A load cell based system was used to obtain a reference mass flow. The drag disc/densitometer combination was found to predict the mass flow with more accuracy than either the turbine/densitometer or drag disc/turbine combinations, when comparing the results with the reference mass flow. The drag disc/densitometer combination was within +-6.3% of the reference integrated mass flow for all tests. Results of the comparisons and the accuracies stated therein are expected to hold for the DTT rake assemblies installed at the Loss-of-Fluid-Test (LOFT) Facility.

11147 **(CONF-810406—9) Automated data qualification.** Good, R.R.; Brower, R.W.; Goodrich, L.D. Jr. (EG and G Idaho, Inc., Idaho Falls (USA)). 29 Apr 1981. Contract AC07-76ID01570. 5p. NTIS, PC A02/MF A01. File Number TI85004754.

From 27. international instrumentation symposium; Indianapolis, IN, USA (27 Apr 1981).

Fundamental to successful development and application of computer technology to aid the human in operation of large, complex plant control systems, is the need to validate data before presentation at the man-machine interface. At EG & G Idaho, Inc., we are developing a methodology to objectively perform automated data qualification based on: (1) On-line analysis of the time series outputs from measurement systems taken individually and redundantly. (2) The known performance characteristics of data acquisition systems. (3) The agreement, or disagreement, between predicted (modeled) and measured phenomena. Developed techniques are being applied to experimental and process control measurements at the Loss-of-Fluid Test (LOFT) reactor facility at the Idaho National Engineering Laboratory (INEL).

11148 **(CONF-810406—10) Development of a cooled coaxial low flow velocimeter.** Englert, S.B.; Fincke, J.R.; Wilson, M.L.; Wolf, J.R. (EG and G Idaho, Inc., Idaho Falls (USA)). 1981. Contract AC07-76ID01570. 14p. NTIS, PC A02/MF A01. File Number TI85004539.

From 27. international instrumentation symposium; Indianapolis, IN, USA (27 Apr 1981).

A cooled coaxial probe was developed to measure low velocity single-phase liquid flow for loss-of-coolant accident (LOCA) small break testing in the Loss-of-Fluid Test (LOFT) Facility at the Idaho National Engineering Laboratory (INEL). The cooled coaxial probe has been tested in the Semiscale Facility and calibrated in a high temperature/pressure test loop in saturated conditions. The design of the cooled coaxial probe described in this paper has shown it to be calibratable and sensitive to velocity changes in the range of 0.05 to 2.5 m/s.

11149 **(CONF-810801—54) Experimental verification of the behavior of surface flaws in thick-walled steel cylinders during severe thermal shock.** Cheverton, R.D.; Holz, P.P.; Bolt, S.E.; Iskander, S.K. (Oak Ridge National Lab., TN (USA)). 1981. Contract AC05-84OR21400. 15p. NTIS, PC A02/MF A01. File Number TI85004519.

From 6. international conference on structural mechanics in reactor technology; Paris, France (17 Aug 1981).

The fracture-toughness data evaluated by means of the J-integral method and obtained from 1T and 2T-CT specimens exhibited large scatter (~ +-50%), and it appears, based on results of TSE-5 and 5A, that long flaws in these materials will behave in accordance with the lower bound of the lab data. If an appropriate lower-bound toughess is used, it appears that LEFM is valid for long flaws in thick-walled steel cylinders under severe thermal-shock loading conditions. Crack initiation will not take place during severe thermal-shock loading conditions while K_1 is decreasing with time even though (K_1/K/sub 1c/ much greater than 1 (checked to 2.3); that is, WPS is effective. Dynamic effects at arrest are negligible, and the static arrest concept is valid for the conditions encountered in the three thermal-shock experiments. Arrest will take place in a rising K_1 field in accordance with lab K/sub 1a/ data measured with $dK_1/da < 0$. Under severe thermal-shock loading conditions a short surface flaw can extend on the surface to effectively become a long flaw and then behave accordingly. Thus, concern over the behavior of long flaws is justified.

11150 **(CONF-810803—21) FRAP-T5 uncertainty study of five reactor transient and accident events.** Laats, E.T. (EG and G Idaho, Inc., Idaho Falls (USA)). 1981. Contract AC07-76ID01570. 11p. NTIS, PC A02/MF A01. File Number TI85004741.

From Topical meeting on reactor safety aspects of fuel behavior; Sun Valley, ID, USA (2 Aug 1981).

The FRAP-T5 fuel rod behavior code, with its recently developed automated uncertainty analysis option, was used to calculate rod behavior for five reactor transient and accident events. Included were locked rotor, rod ejection, steam line break, loss of flow, and turbine trip without bypass events. The intent was to identify the limiting Nuclear Regulatory Commission (NRC) fuel rod damage criteria based on best estimate calculations with associated uncertainties, rather than the traditional calculations that utilize conservative evaluation models. Conclusions are reported regarding the likelihood and subsequent consequences of exceeding the fuel rod damage limits.

11151 **(CONF-810803—22) Damage and failure of previously irradiated fuel rods during a reactivity initiated accident.** McCardell, R.K.; Martinson, Z.R.; MacDonald, P.E. (EG and G Idaho, Inc., Idaho Falls (USA)). 1981. Contract AC07-76ID01570. 16p. NTIS, PC A02/MF A01. File Number TI85004745.

From Topical meeting on reactor safety aspects of fuel behavior; Sun Valley, ID, USA (2 Aug 1981).

Light-water-reactor fuel damage during a reactivity initiated accident (RIA) is assessed and comments on the adequacy of the present Nuclear Regulatory Commission (NRC) design requirements for an RIA are presented. Results from recent RIA Power Burst Facility tests with previously irradiated fuel rods indicate that the principal fuel rod and cladding damage mechanisms, in chronological order, are pellet-cladding mechanical interaction, plastic deformation, fuel swelling and cladding rupture, cladding oxidation and embrittlement during film boiling, and fragmentation of cladding and fuel powdering during quench.

11152 **(CONF-810803—23) Assessment of nuclear fuel rod and solid electric heater thermal behavior during the heatup and reflood phases of a large break LOCA.** Broughton, J.M.; Golden, D.W.; MacDonald, P.E. (EG and G Idaho, Inc., Idaho Falls (USA)). 1981. Contract AC07-76ID01570. 12p. NTIS, PC A02/MF A01. File Number TI85004746.

From Topical meeting on reactor safety aspects of fuel behavior; Sun Valley, ID, USA (2 Aug 1981).

The Halden Project Test Program Instrumented Fuel Assembly 511 is designed to systematically evaluate the ability of electric heater rods to simulate the response of nuclear fuel rods during the heatup and reflood phases of a large break loss-of-coolant accident. The test rods were also instrumented with both external and internal cladding thermocouples to determine if external thermocouples provide an accurate measurement of cladding temperature. This paper presents an evaluation of the results from two of three planned test series using nuclear test rods and solid-type electric heater rods. Results from RELAP5 computer code calculations are also discussed. The primary results were that (a) the nuclear fuel rods quenched substantially earlier than the electric rods and (b)

the external thermocouples measured lower temperatures than the internal thermocouples, and possibly induced early quench.

11153 **(CONF-810804—18) Ability of the TRAC-P1A computer program to predict blowdown, refill, and reflood phenomena during Semiscale Mod-1 experiments.** Demmie, P.N. (EG and G Idaho, Inc., Idaho Falls (USA)). 1981. Contract AC07-76ID01570. 12p. NTIS, PC A02/MF A01. File Number TI85004750.

From National heat transfer conference; Milwaukee, WI, USA (2 Aug 1981).

A computer analysis of a Semiscale Mod-1 loss-of-coolant experiment (LOCE) was performed using the TRAC-P1A computer program. The main purpose of this analysis was to contribute data for use in assessing the ability of TRAC-P1A to predict blowdown, refill, and reflood phenomena during a postulated loss-of-coolant accident (LOCA). A Semiscale Mod-1 system model was created and TRAC-P1A was used to obtain initial conditions for Semiscale Mod-1 LOCE S-04-6. After this initialization, TRAC-P1A was used to simulate the first 60 s of this experiment. The results of this simulation are presented and discussed.

11154 **(CONF-810804—21) Mechanistic accumulator model for light water reactor transient analysis.** Carlson, K.E.; Slegel, D.L.; Ransom, V.H.; Trapp, J.A. (Idaho National Engineering Lab., Idaho Falls (USA)). 1981. Contract AC07-76ID01570. 16p. NTIS, PC A02/MF A01 - GPO. File Number TI85004744.

From National heat transfer conference; Milwaukee, WI, USA (2 Aug 1981).

A lumped parameter accumulator model has been developed and installed into the computer program RELAP5. The model includes heat transfer from the wall of the tank, from the water surface to the dome, vaporization from the water surface to the dome, and condensation of vapor in the dome. The last feature also includes heat addition to the nitrogen dome due to the condensing process. Results from data comparisons are presented.

11155 **(CONF-841105—52) Two-dimensional modeling of sodium boiling in a simulated LMFBR loss-of-flow test.** Rose, S.D. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005382.

From Joint meeting of the American Nuclear Society and the Atomic Industrial Forum; Washington, DC, USA (11 Nov 1984).

Loss-of-flow (LOF) accidents are of major importance in LMFBR safety. Tests have been performed to simulate the simultaneous failure of all primary pumps and reactor shutdown systems in a 37-pin electrically heated test bundle installed in the KNS sodium boiling loop at the Institute of Reactor Development, Karlsruhe. The tests simulated LOF conditions of the German prototype LMFBR, the SNR 300. The main objectives of these tests were to characterize the transient boiling development to cladding dryout and to provide data for validation of sodium boiling codes. One particular LOF test, designated L22, at full power was selected as a benchmark exercise for comparison of several codes at the Eleventh Meeting of the Liquid Metal Boiling Working Group (LMBWG) held in Grenoble, France, in October 1984. In this paper, the results of the calculations performed at ORNL with the two-dimensional (2-D) boiling code THORAX are presented.

11156 **(CONF-841105—54) UO_2 aerosol release from pools of sodium.** Petrykowski, J.C.; Longest, A.W.; Wright, A.L. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005377.

From Joint meeting of the American Nuclear Society and the Atomic Industrial Forum; Washington, DC, USA (11 Nov 1984).

Experiments in ORNL's Fuel Aerosol Simulant Test (FAST) facility measure the release of UO_2 aerosols from sodium pools to assess the potential release of fuel aerosols from LMFBRs following hypothetical core disruptive accidents (HCDAs). In nine under-sodium experiments recently completed, aerosol concentrations in the cover gas were lower than concentrations in Wright's underwater experiments. Analysis of heat transfer between the UO_2 and pool reveals that greater subcooling and higher thermal diffusivity of sodium are responsible for reductions in aerosol concentrations.

11157 **(CONF-841105—57) Behavior of Cs, I, and Tc in the fission product release program at ORNL.** Collins, J.L.; Osborne, M.F.; Lorenz, R.A. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01 - GPO. File Number TI85005369.

From Joint meeting of the American Nuclear Society and the Atomic Industrial Forum; Washington, DC, USA (11 Nov 1984).

Experiments have been conducted at ORNL with highly irradiated light-water reactor (PWR and BWR) fuel rod segments to investigate fission product release in steam in the temperature range 500 to 2000°C. Objectives were to quantify and characterize the releases under conditions postulated for LOCA) and severe accident conditions. In all, 26 experiments have been conducted - 24 with high burnup and 2 with low burnup fuels. To aid in the interpretation of fission product release, 12 implant and 18 control experiments were also conducted; the behavior of HI, I_2, Cs_2O, CsOH, Te, and TeO_2 (individually and in different combinations) was studied. This paper discusses only the observed behavior of cesium, iodine, and tellurium. Cs and I were released primarily as CsOH and CsI, and Te release was controlled by steam oxidation of Zircaloy cladding.

11158 **(CONF-8410142—10) Calculation of thermal mixing for the BWR Mark I cantainment pressure suppression pool.** Cook, D.H. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 1984. Contract AC05-84OR21400. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85000270.

From 12. water reactor safety research information meeting; Gaithersburg, MD, USA (23 Oct 1984).

The purpose of this work is to develop and verify a model for calculating pressure suppression pool (PSP) local temperature versus time. The emphasis in the work is on the PSP temperature response to a single safety relief valves (SRV) discharging to the pool. An important part of the model is to correctly predict the velocity field in the PSP that is induced by a single safety relief valve discharge. The resulting velocity distribution is then used to predict the temperature distribution in the pool. The temperature distribution in turn feeds back into the velocity field and affects the condensation source. Although the emphasis in this work is on the effects of a single T-quencher discharging to a cold PSP, several extensions of the work were performed. These extensions are described.

11159 **(CONF-8410173—10) Radiological consequence analysis with HEU and LEU fuels.** Woodruff, W.L.; Warinner, D.K.; Matos, J.E. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 17p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005048.

From International meeting on reduced enrichment for research and test reactors; Argonne, IL, USA (14 Oct 1984).

A model for estimating the radiological consequences from a hypothetical accident in HEU and LEU fueled research and test reactors is presented. Simple hand calculations based on fission product yield table inventories and non-site specific dispersion data may be adequate in many cases. However, more detailed inventories and site specific data on meteorological conditions and release rates and heights can result in substantial reductions in the dose estimates. LEU fuel gives essentially the same doses as HEU fuel. The plutonium buildup in the LEU fuel does not significantly increase the radiological consequences. The dose to the thyroid is the limiting dose. 10 references, 3 figures, 7 tables.

11160 **(EPRI-NP—3243-CCM-Vol.2) BEAGL-01: a computer code for calculating rapid LWR core transients. Volume 2. User's manual.** Aronson, A.L.; Diamond, D.J. (Brookhaven National Lab., Upton, NY (USA)). Oct 1984. Contract AC02-76CH00016. 112p. NTIS, PC E06/MF A01; 1 - EPRI $14.50; GPO Dep. File Number DE85003280.

BEAGL-01 is a computer program for calculating the conditions in an LWR core at steady state and while undergoing a transient. It couples a neutron kinetic model in cylindrical (r,z) geometry with a two-phase thermal-hydraulic model for multiple parallel

channels. Appropriate applications include reactivity insertion accidents in both pressurized reactors and BWRs and transients in BWRs initiated by perturbations in flow rate, inlet subcooling, or pressure. This volume is a user's manual and contains a description of the input requirements and the output. It also includes sample problem specifications and solutions.

11161 **(GRS-F—132) Reports of reactor safety research projects sponsored by the Federal Ministry for Research and Technology (BMFT).** (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)). Apr 1984. 439p. (In German). NTIS (US Sales Only), PC A19/MF A01. File Number DE85750305.

Each progress report represents a compilation of individual reports about objectives, the work performed, the results, the next steps of the work. The individual reports are prepared in a standard form by the contractors themselves as a documentation of their progress in work and published by the FB (Research Coordination Department), Forschungsbetreuung at the GRS, within the framework of general information of progress in reactor safety research. The individual reports are classified according to the research program on the safety of LWRS 1977-1980 of the BMFT. Another table of contents uses the same classification system as applied in the nuclear safety index of the CEC (Commission of the European Communities) and the OECD (Organization for Economic Cooperation and Development). The reports are arranged in the sequence of their project numbers.

11162 **(GRS-F—136) List of reports on reactor safety research of BMFT, CEA, EPRI, JSTA and USNRC.** (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)). Jul 1984. 50p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE85750277.

This list reviews reports from the Federal Republic of Germany, from France, from Japan and from the United States of America concerning special problems in the field of reactor safety research. According to the cooperation of the Bundesminister fuer Forschung und Technologie (BMFT) with the Commissariat a l'Energie Atomique (CEA), the Japan Science and Technology Agency (JSTA), the Electric Power Research Institute (EPRI) and the United States Nuclear Regulatory Commission, these reports are available in the Gesellschaft fuer Reaktorsicherheit (GRS). The list pursues the following order: Country of origin, problem area concerned, according to the Reactor Safety Research Programm of the BMFT, reporting organization. The list of reports appears quarterly. Requests for reports should be addressed to GRS, Forschungsbetreuung. Contractual points of view have to be considered for the distribution of the reports.

11163 **(INIS-mf—8872) Experimental investigation of the performance of pressurizer safety valves during single- and two-phase flow (ATWS). Final report.** Dernbach, B. (Kraftwerk Union A.G., Erlangen (Germany, F.R.). Abt. Labor Komponenten-Pruefung). (Kraftwerk Union A.G., Erlangen (Germany, F.R.). Hauptbereich Reaktortechnik). Apr 1983. 182p. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE85780117.

Experimental investigation of the performance of pressurizer safety valves during single- and two-phase flow has shown that the overall pressurization system reliably prevents excess pressure in the primary system, not only under normal conditions, but also under ATWS conditions. A significant increase in reserve power for valve actuation has been achieved by slight structural modifications for all fluid flow conditions. The main safety valve will open and/or remain open even if the pilot safety valve is unstable in operation. Start-up tests performed by the NPP Grafenrheinfeld utility showed that the findings of these experiments are similar to behaviour under operational conditions.

11164 **(KFK—3716) Significance of cesium in LMFBR and LWR safety analysis.** Breitung, W.; Schumacher, G. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik). May 1984. 50p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85750289.

The significance of cesium, which is the most abundant volatile fission product in reactor fuels, is shown for LMFBR and LWR safety analysis. The conclusion for the LMFBR case is that apparently a high potential for fuel motion induced by cesium pressures exists. The magnitude of this effect should be clarified by in-pile vapor pressure measurements on Cs_2UO_4 and Cs_2UOsub(3.56). In the LWR case, cesium isotopes play an important role in the overall health risk from released fission products. Cesium vapor pressure measurements on Cs_2MoO_4 and Cs_2UO_4 would provide fundamental input data for mechanistic LWR release codes which are presently under development at different laboratories. A test matrix of five experiments is proposed. The tests are based on already existing in-pile techniques.

11165 **(KFK—3770) Frequency distributions of activity concentrations after accidential releases of radionuclides.** Ehrhardt, J.; Zoeller, U. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Nukleare Sicherheit). Aug 1984. 62p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE85750297.

The increasing application of risk assessments for nuclear installations in decision making procedures also requires to analyse intermediate results of accident consequence calculations in detail. The activity concentrations to be expected are an important quantity especially to judge the effectiveness and feasibility of technical, administrative and medical emergency actions. For this reason, a modified version of the accident consequence code UFOMOD was developed, which allows to calculate frequency distributions of activity concentrations. In the report, graphical and numerical forms of presentation demonstrating the relationships between frequency, activity concentration, affected areas and the number of persons living there are described and discussed. This is done exemplarily using the results of accident consequence calculations for the nuclides I-131 and Cs-137 based on the release category FK2 of the "German Risk Study".

11166 **(NUREG—0420-Suppl.8) Safety Evaluation Report related to the operation of Shoreham Nuclear Power Station, Unit No. 1 (Docket No. 50-322). Supplement No. 8.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Dec 1984. 100p. NTIS, PC A05/MF A01 - GPO* $4.75. File Number TI85900849.

Supplement 8 (SSER 8) to the Safety Evaluation Report on Long Island Lighting Company's application for a license to operate the Shoreham Nuclear Power Station, Unit 1, located in Suffolk County, New York, has been prepared by the Office of Nuclear Reactor Regulation of the US Nuclear Regulatory Commission. This supplement addresses several items that have been reviewed by the staff since the previous supplement was issued.

11167 **(NUREG/CP—0051) CSNI specialist meeting on leak-before-break in nuclear reactor piping: proceedings.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research). Aug 1984. 562p. (CONF-8309187—). NTIS, PC A24/MF A01 - GPO* $10.00. File Number TI84901888.

From CSNI leak-before-break conference; Monterey, CA, USA (1 Sep 1983).

CSNI Report No. 82.

On September 1 and 2, 1983, the CSNI subcommittee on primary system integrity held a special meeting in Monterey, California, on the subject of leak-before-break in nuclear reactor piping systems. The purpose of the meeting was to provide an international forum for the exchange of ideas, positions, and research results; to identify areas requiring additional research and development; and to determine the general attitude toward acceptance of the leak-before-break concept. The importance of the leak-before-break issue was evidenced by excellent attendance at the meeting and through active participation by the meeting attendees. Approximately 125 people representing fifteen different nations attended the meeting. The meeting was divided into four technical sessions addressing the following areas: Application of Piping Fracture Mechanics to Leak-Before Break, Leak Rate and Leak Detection, Leak-Before-Break Studies, Methods and Results, Current and Proposed Positions on Leak-Before-Break.

11168 **(PNL—5331) Consequence analysis of a hypothetical contained criticality accident in the Hanford Critical Mass Laboratory.** Gore, B.F.; Strenge, D.L.; Mishima, J. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1984. Contract AC06-76RL01830. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005429.

The original hazards summary report (i.e., SAR) for the CML addressed the consequences of a hypothetical accidential critical excursion occurring with the experimental assembly room open. That report indicated that the public would receive insignificant radiation exposure regardless of the type of atmospheric condition, while plant personnel could possibly receive exposures greater than the annual exposure limits for radiation workers, when a strong inversion existed. This analysis investigates the consequencs of a hypothetical accident criticality occurring with the experimental assembly room sealed. Due to the containment capabilities designed and built into the critical assembly room, the consequences are greatly reduced below those presented in HW-66266. Despite the incorporation of many extremely conservative assumptions to simplify the analysis, the radiation doses predicted for personnel 100 meters or more distant from the CML are found to be smaller than the annual radiation dose limit for members of the public in uncontrolled areas during routine, nonaccident operations. Therefore, the results of this analysis demonstrate that the occurrence of a hypothetical critical excursion within the sealed experimental assembly room at the Hanford Critical Mass Laboratory presents only a small, acceptable risk to personnel and facilities in the area and no additional safety systems or controls are needed for the continued safe operation of the CML. 11 references, 4 tables. (ACR)

11169 **(SAND—84-1811C) Overview of methods for uncertainty analysis and sensitivity analysis in probabilistic risk assessment.** Iman, R.L.; Helton, J.C. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 11p. (CONF-840295—3). NTIS, PC A02/MF A01; GPO Dep. File Number TI85003532.

From ANS/ENS topical meeting on probabilistic safety methods and applications; San Francisco, CA, USA (24 Feb 1984).

In this paper, available methods for uncertainty analysis and sensitivity analysis in a PRA are reviewed. This review first treats methods for use with individual components of a PRA and then considers how these methods could be combined in the performance of a complete PRA. The goal of uncertainty analysis is to measure the imprecision in PRA outcomes of interest, and the goal of sensitivity analysis is to identify the major contributors to this imprecision. 56 references.

11170 **(SAND—84-1843C) Regulatory analyses for severe accident issues: an example.** Burke, R.P. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 10p. (CONF-850206—14). NTIS, PC A02/MF A01; GPO Dep. File Number DE85004012.

From International ANS/ENS topical meeting on probabilistic safety methods and applications; San Francisco, CA, USA (24 Feb 1985).

A study has been performed as part of a program to establish methods for incorporation of information from a broad range of research programs, particularly those which generate probabilistic risk information, and to develop suitable presentation formats for providing guidance to decisionmakers on issues related to severe accidents. The study addresses issues related to information availability, content, and presentation formats for use in the regulatory decisionmaking process. The approach employed to address these issues was to perform an example regulatory analysis on representative topics of interest using available technical information. The issue examined in the example analysis is the implementation of either a vented containment system or an alternative decay heat removal system at the Peach Bottom No. 2 plant. The example demonstrates many of the problems which will be encountered as probabilistic information from ongoing programs is incorporated into the regulatory decisionmaking process.

11171 **(SAND—84-1845C) Interaction of hot solid, core debris with concrete.** Copus, E.R.; Bradley, D.R. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 3p. (CONF-8410142—30). NTIS, PC A02/MF A01; GPO Dep. File Number DE85002640.

From 12. water reactor safety research information meeting; Gaithersburg, MD, USA (23 Oct 1984).

The objective of the Hot Solid Program is to measure, model, and assess the long term interactions of solid core debris with concrete. This type of long term interaction, which includes basemat erosion, flammable and non-flammable gas evolution, long term fission product release, and the overall core-concrete heat balance, will occur following a catastrophic core melt accident when degraded core materials solidify after prolonged contact with the concrete basemat. It will also occur when an ex-vessel steam explosion forms a fragmented core debris bed. The thermal, gas evolution, and fission product source terms produced as a consequence of hot solid core-concrete interactions are the governing phenomena in any long term post-accident containment integrity evaluation or risk/consequence analysis. At present, the data base and computer models used to estimate the potential post-accident containment failure probability and associated consequences include only short-term transient effects at temperatures and heat fluxes resulting from decay heat powers greater than .5 W/g. The Hot Solids program will measure, model, and assess the thermal, gas evolution, and fission product source that result from decay heat powers in the .1 to .01 W/g range. This information will be used both to expand the present post-accident phenomena data base and to extend the range of current accident analysis computer models such as CORCON and MEDICI so that long term core-concrete interactions are included in addition to the short-term transient effects.

11172 **(SAND—84-2216C) Behavior of core debris ejected from a pressurized vessel into scaled reactor cavities.** Tarbell, W.W.; Pilch, M.; Brockmann, J.E. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 18p. (CONF-8410142—65). NTIS, PC A02/MF A01; GPO Dep. File Number DE85003340.

From 12. water reactor safety research information meeting; Gaithersburg, MD, USA (23 Oct 1984).

Results from four recent 1:10 scale experiments are presented along with analyses of the possible consequences for plant geometries. The tests cover a range in initial system pressure from 4 to 12 MPa, with either dry or water-filled cavities. Nearly all of the core debris is dispersed from the cavity with less than five percent (5%) of the original mass found adhered to the exposed cavity surfaces. Those tests involving water in the cavity show the water being expelled as a slug ahead of the dispersed melt. Models for the interaction of the ejected core debris with the containment atmosphere show that both thermal and chemical energy is liberated from the debris. The calculated pressurization from direct heating of the containment atmosphere can threaten even the most robust containments. Models and experiments are currently being devised to study the possible mitigating effects of the above-cavity structures.

11173 **(SAND—84-2282C) Preliminary observation of large scale UO_2 melt-concrete interactions and sustained steel-concrete interaction with an overlying water pool.** Gronager, J.E.; Suo-Anttila, A.J.; Acton, R.; Bradley, D.R.; Blose, R.L. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 27p. (CONF-8410142—34). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85002622.

From 12. water reactor safety research information meeting; Gaithersburg, MD, USA (23 Oct 1984).

An experiment description, presentation of results and an analysis of the results using a heat balance approach have been performed for the TURC-2 and SWISS-1 tests. In addition a CORCON comparison has been made for both tests also. The TURC-2 tests, a transient UO_2/ZrO_2 concrete interaction test, showed no ablation for the duration of the test. Calculations indicate that stable crusting occurred immediately and prevented any erosion. In contrast, the CORCON comparison showed several cm of erosion, which implies the need for further code development and/or refinement. The SWISS-1 test was a sustained stainless steel concrete interaction test with water addition. The experimental result indicated a continuous steady erosion rate that was weakly coupled to the power generation rate for the duration of the test. Water addition showed no effect upon the erosion rate. This was attributed to the presence of a thick crust that effectively insulated steel melt from the water. A CORCON calculation indicated only

half the erosion observed, again implying the need for further code development and refinement.

11174 **(EPRI-NP—1850-CCM-Vol.3-Rev.2) RETRAN-02: a program for Transient Thermal-hydraulic Analysis of Complex Fluid Flow Systems. Volume 3. User's manual. Revision 2.** Peterson, C.E.; McFadden, J.H.; Paulsen, M.P.; Gose, G.C. (Energy, Inc., Idaho Falls, ID (USA)). Oct 1984. 593p. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303. File Number TI85920102.

RETRAN-02 (Revision 2) represents a significant achievement in the development of a versatile and reliable computer program for use in best-estimate transient thermal-hydraulic analysis of LWR systems. The RETRAN-02 computer program is an extension of the RETRAN-01 program designed to provide analysis capabilities for: (1) BWR and PWR transients; (2) small-break loss-of-coolant accidents; (3) balance-of-plant modeling; and (4) anticipated transients without scram, while maintaining the analysis capabilities of the predecessor code. The RETRAN-02 computer code is constructed in a semimodular and dynamic, dimensioned form in which additions to the code can be easily carried out as new and improved models are developed. This report (the third of a four-volume computer code manual) describes the required input, the code output, and shows a number of sample problems run with RETRAN. The three companion volumes describe the theory and numerical algorithms, the programming details, and the verificationa nd qualification performed with RETRAN.

11175 **(EPRI-NP—1850-CCM-Vol.2-Rev.2) RETRAN-02: a program for Transient Thermal-hydraulic Analysis of Complex Fluid Flow systems. Volume 2. Programmer's manual. Revision 2.** Peterson, C.E.; McFadden, J.H.; Paulsen, M.P.; Gose, G.C. (Energy, Inc., Idaho Falls, ID (USA)). Oct 1984. 397p. Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303. File Number TI85920126.

RETRAN-02 (Revision 2) represents a significant achievement in the development of a versatile and reliable computer program for use in best-estimate transient thermal-hydraulic analysis of LWR systems. The RETRAN-02 computer program is an extension of the RETRAN-01 program designed to provide analysis capabilities for: (1) BWR and PWR transients; (2) small-break loss-of-coolant accidents (LOCAs); (3) balance-of-plant modeling; and (4) anticipated transients without scram, while maintaining the analysis capabilities of the predecessor code. The RETRAN-02 computer code is constructed in a semimodular and dynamic, dimensioned form in which additions to the code can be easily carried out as new and impoved models are developed. This report (the second of a four-volume computer code manual) describes the programming aspects of the RETRAN-02 code. Three companion volumes describe the theory and numerical algorithms, the programming details, and the verification and qualification performed with RETRAN.

25 ENERGY STORAGE

2502 Compressed Gas

11176 **(PNL-SA—10729) Stability criteria for storage of compressed air in hard rock reservoirs.** Allen, R.D.; Doherty, T.J. (Pacific Northwest Lab., Richland, WA (USA)). Mar 1983. Contract AC06-76RL01830. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005521.

The geological reservoir environment considered in this paper consists of a hard rock formation with adequate depth, geometry, lithology, strength, hydraulic head, and absence of negative features such as a high lateral stress field. High excavation costs dictate that a CAES reservoir in hard rock be a nearly constant pressure, water-compensated cavern. Design concerns associated with the daily operational temperature cycling and wall wetting include: (1) hard rock properties at non-ambient conditions; (2) residual strength of hard rock after failure; (3) mineralogical alteration of hard rock under CAES conditions; (4) cavern geometry and size; (5) thermal shock; (6) low frequency fatigue; and (7) air penetration of the rock mass. Furthermore, rapid exsolution of air in the compensating water column during air injection must be prevented. With these considerations in mind, a number of design and stability criteria were established.

2506 Thermal

REFER ALSO TO CITATION(S) 25060011286

11177 **(ORNL/Sub—83-13858/1) Feasibility study of binary solutions for thermal energy storage in high and low temperature applications.** Grodzka, P. (Lockheed Missiles and Space Co., Inc., Huntsville, AL (USA). Research and Engineering Center). Dec 1984. Contract AC05-84OR21400. 55p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85004952.

Four categories of conjugating binary (CB) solutions were investigated and assessed for practical dual temperature heat storage systems. The categories were CBs capable of clathration and/or monotectic reaction, closed-loop CBs, liquid or supercritical gas CBs, and high temperature CBs. CBs that undergo endothermic solution (hill-type CB behavior) at the higher temperature clathrate and/or monotectic reaction at the lower temperature appear most likely to be adaptable to practical dual temperature TES for applications such as building heating and cooling. An economic analysis of a representative CB in this category for load leveling applications indicates promise. In the high temperature range, the CB-monotectic system Na-NaCl compares favorably economically with systems based on sensible and latent heat of fusion systems. Enhanced heat transfer rates because of avoidance of crystal growth on heat transfer surfaces during clathrate/monotectic or CB phase change should considerably improve these preliminary economic projections for CB systems. The study also identified the CB-clathrate/monotectic systems of propylene carbonate + water and SO_2 + water which may be of eventual practical interest.

2508 Chemical

11178 **High temperature gas reactor and energy pipeline system.** Daniels, E.; Blazek, C.; Pflasterer, G.R.; Allen, D.C. *9th Int. Pipeline Technol. Conf.;* 87-108(1981). (CONF-810209—).

From 9. international pipeline technology conference; Houston, TX, USA (24 Feb 1981).

Under contract to the General Electric Co. as a part of a DOE-sponsored program, the Energy Systems Analysis Group at the Institute of Gas Technology examined the following aspects of the high temperature gas reactor closed loop chemical energy pipeline concept: (1) pipeline transmission and storage system design; (2) pipeline and storage system cost; (3) methane reformer interface; and (4) system safety and environmental aspects. This work focuses on the pipeline and storage system concepts, pipeline size, compressor power, and storage facility requirements were developed for 4 different types of pipeline systems to obtain system cost estimates. Each pipeline system includes a synthesis-gas pipeline from the reformer to the methanator, a methane-rich gas pipeline from the methanator to the reformer, a water return line from the methanator to the reformer, and storage for the synthesis gas, methane-rich gas and water.

2509 Batteries

REFER ALSO TO CITATION(S) 25090011318

11179 **(CONF-831086—14) Mechanism and kinetics of iron electrode dissolution in KOH electrolytes.** Poa, D.S.; Miller, J.F.; Yao, N.P. (Argonne National Lab., IL (USA)). 1983. Contract W-31-109-ENG-38. 3p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005039.

From Electrochemical Society fall meeting; Washington, DC, USA (9 Oct 1983).

The studies described in this paper were made to determine the effects of adding LiOH, K_2S, or FeO to the KOH electrolytes, and the variation of KOH concentration on the dissolution behavior of iron electrodes. LiOH is used as a standard component in al-

kaline electrolytes in nickel-iron cells, and it has been reported that the charge inefficiency of the iron electrode caused by H_2 gas evolution can be reduced by the addition of sulfur-bearing anion to the electrolyte. The study of the FeO additive was included solely to aid in the understanding of the iron dissolution mechanism. Studies were performed using both cyclic volammetric and rotating ring-disc electrode (RRDE) techniques.

11180 **Wetting characteristics of sodium on β''-alumina and on nasicon.** Viswanathan, L.; Virkar, A.V. (Univ. of Utah, Salt Lake City). *Journal of Materials Science;* **17**: 753-759(1982). Contract AC02-77ER04451.

The sessile drop technique was used to determine the wetting characteristics of liquid sodium on β''-alumina and nasicon ($Na_3Zr_2Si_2PO_{12}$). The effects of moisture and temperature were studied using the wetting experiments. A range of contact angles (from 0 to 160°) were observed. The samples exposed to moisture exhibited poor wetting. The fact that good wetting is a prerequisite for improved cell performance was demonstrated via Na absolute valueβ''-alumina Na cell tests. Cells baked out in a vacuum passed in excess of 1 100 A h cm^{-2} at 4 A cm^{-2} current density without any degradation. Unbaked cells under similar conditions failed under 200 A h cm^{-2}.

11181 **Some aspects of breakdown of β''-alumina solid electrolyte.** Virkar, A.V. (Univ. of Utah, Salt Lake City). *Journal of Materials Science;* **16**: 1142-1150(1981). Contract AC02-77ER04451.

A theoretical expression is derived for the pressure generated in the sodium-filled cracks of β''-alumina under electrolytic conditions by treating the flux of sodium ions to the cracks in terms of the Laplace equation for the appropriate boundary conditions. It is demonstrated that the pressure generated decreases with increasing crack length for a given current density in contrast to the predictions of some investigators. It is suggested that some other factors must be considered if the microfracture model via Poiseuille pressure is to be a viable mechanism for electrolyte degradation.

29 ENERGY PLANNING AND POLICY

REFER ALSO TO CITATION(S) 29000012026, 12027, 12028, 12029

2901 Energy Analysis And Modeling

11182 **(DOE/EIA—M002) Model documentation for the mini-macroeconomic model: MINMAC.** Moody, C.E. Jr.; Curtis, W.P. (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). [1984]. 49p. NTIS, PC APC A03/MF A01 - GPO; GPO Dep. File Number DE85006325.

The Mini-Macroeconomic Model (MINMAC) is the macroeconomic component of the Intermediate Future Forecasting System (IFFS). It provides forecasts of deviations from a given base case for eight important macroeconomic variables utilized by IFFS for energy demand forecasts: real Gross National Product (GNP), price level, disposable income, unemployment, housing starts, manufacturing output, the interest rate on corporate bonds, and the mortgage rate. Such projections must be repeatedly computed in the course of using IFFS. In the past, such projections were prepared using relatively cumbersome and expensive large macroeconomic models. MINMAC was developed to simplify this computational process and is primarily intended to be used as a module of IFFS. The model is a linear econometric approximation of a large-scale macroeconometric model, the Annual Scenario Model developed by Data Resources, Inc. (DRI). The model is estimated on pseudodata generated by simulating the DRI Model over several years using various assumptions concerning domestic and foreign energy prices. Ordinary least squares regressions of each of the eight simulated variables on the assumed energy prices yields the linear approximation used in the model. The national model includes one submodel, the Industrial Output module. This module uses elasticities estimated from historical data to translate changes in overall manufacturing output predicted by MINMAC into implied changes in manufacturing industries at the two-digit Standard Industrial Classification (SIC) level. These changes are then allocated to states and regions using historically estimated ratios of the Regional Sharing (REGSHR) model. 1 figure, 4 tables.

2902 Economics And Sociology

REFER ALSO TO CITATION(S) 29020010879, 10930, 10941, 10945, 10946, 11182, 11184, 11213, 11214

11183 **Energy use: the human dimension.** Stern, P.C.; Aronson, E. (eds.). New York, NY; W.H. Freeman and Co. (1984). 248p. (DOE/PE/70290—T1). W.H. Freeman and Co., 41 Madison Ave., New York, NY 10010. File Number TI85005416. Contract FG01-80PE70290.

This report is a serious effort at understanding major social and political components of energy policy. This book shows that it is impossible to make effective energy policy without understanding the continuing social conflict over the nature of energy and the many noneconomic factors that influence its use. Conclusions emphasize the importance of seeing energy problems and solutions in terms of social systems rather than single causes; designing energy systems for adaptability as an alternative to detailed planning; and treating energy policies and programs as the social experiments they are. (DLC)

2903 Environment, Health, And Safety

REFER ALSO TO CITATION(S) 29030011614, 11627

11184 **(CONF-841136—3) Integration of energy/economic models for environmental assessments and policy analysis.** Hanson, D.A.; Macal, C.M.; Hochheiser, H.G.; Huntington, H.G. (Argonne National Lab., IL (USA); USDOE, Washington, DC; Stanford Univ., CA (USA). Energy Modeling Forum). 1984. Contract W-31-109-ENG-38. 20p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004084.

From 6. annual North American meeting of the International Association of Energy Economists; San Francisco, CA, USA (5 Nov 1984).

This paper focuses on some issues related to linking together a set of detailed energy and economic models designed to calculate emissions and central costs as part of an environmental assessment or policy study. The series of forthcoming acid precipitation assessments are taken as the context. Separate detailed models with different structure have been developed for the major emitting sectors. A brief overview of the model set and the economic input data that drives the sectoral models is presented. Some preliminary estimates concerning the feedback effects of energy prices on economic growth are presentes. 7 references, 5 tables.

11185 **(DOE/NV/10162—19) Flood hazard assessment on alluvial fans: an examination of the methodology.** French, R.H. (Nevada Univ., Reno (USA). Desert Research Inst.). Aug 1984. Contract AC08-81NV10162. 49p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85004076.

Water Resources Center Publication No. 45040.

The report presents the results of a critical examination of assumptions and methodology recommended by the Federal Emergency Management Agency (FEMA) to assess flood hazard on alluvial fans. The conculsions reached are as follows. First, the assumption that a flow on an alluvial fan has an equal probability of crossing any point on a given contour seems to be a very conservative assumption. Second, given the data from the Nevada Test Site, it would appear that the assumption that fans have critical to supercritical slopes is acceptable. Third, the present methods of estimating channel width and depth on alluvial fans seem to be invalid. Fourth, the specific flood hazard evaluation procedures recommended by FEMA are not valid in some cases because they are based on the assumption that sufficient records exist to do a standard peak flow analysis. Fifth, the validity of the implied assumption that debris flows present no risk can only be assessed after a location on a fan relative to the intersection point has been established. It is concluded that the current methods of flood hazard assessment on alluvial fans are not adequate given the current and projected

economic value of structures and development on alluvial fans in the southwestern United States. 55 references, 5 figures, 5 tables.

11186 **(DOE/PE/70522—T1) Corporate use of information regarding natural resources and environmental quality.** Train, R.E. (World Wildlife Fund, Washington, DC (USA)). 1984. Contract AI01-83PE70522. 97p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85005211.

This report presents findings and recommendations from a one-year study of the corporate use of information regarding natural resources and environmental quality. Personal interviews were conducted with 229 information users at 45 of America's largest corporations, trade associations, and private information companies. In addition, 110 information users participated in a written survey. Our principal findings are: (1) US corporations urgently need more international data; (2) US corporations feel that the government's natural resource forecasts are not credible; (3) US corporations need upgraded and expanded data on environmental quality; (4) US corporations believe that government information is not timely; (5) information on natural resources and environmental quality is vital to the success of US corporations; (6) US corporations depend on a large body of this information in making decisions regarding capacity, siting, marketing, production, and strategic planning among others; and (7) the US government is the principal source of information on natural resources and environmental quality.

11187 **(GAO/RCED—84-188) Status of civilian federal agencies' efforts to address hazardous waste problems on their lands.** Bowsher, C.A. (General Accounting Office, Washington, DC (USA). Office of the Comptroller General). 28 Sep 1984. 117p. US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760. File Number TI85900446.

Report to The Chairman, Subcommittee on Legislative, Committee on Appropriations, House of Representatives.

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (also known as Superfund) was enacted to address problems posed by uncontrolled hazardous waste sites. Federal agencies must comply with the act's requirements to the same extent as private entities. GAO found that 11 of 16 civilian federal agencies identified by GAO as having hazardous waste activities were aware of 340 potential hazardous waste site locations on their lands or under their control. Assessment, evaluation, and corrective action at the 340 locations ranged from 105 where no action had been taken to 73 where Environmental Protection Agency (EPA) or other federal agency officials had concluded that no further action was warranted. Some action had been taken at the remaining 162 locations, but additional actions were needed. GAO also found that EPA's data system, which shows potential hazardous waste site locations and the status of actions performed, was incomplete. GAO recommends that EPA update and correct the data system.

11188 **(GAO/RCED—84-196) Natural resource damage claims and assessment regulations under Superfund.** (General Accounting Office, Washington, DC (USA). Resources, Community and Economic Development Div.). 4 Sep 1984. 10p. US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760. File Number TI85900444.

This report discusses applicable provisions and responsibilities under Superfund legislation, EPA's and Interior's delays in promulgating regulations, states' views on EPA's action to invalidate states' natural resource damage claims submitted to EPA, the impact of Interior's delays in promulgating regulations, state lawsuits filed against EPA and Interior, and recent actions to promulgate Superfund regulations. (ACR)

11189 **(PB—85-112209/XAB) Environmental progress and challenges: an EPA (Environmental Protection Agency) perspective.** Crampton, L.S.W.; Kelly, C.C.; Hiemstra, S.L. (Environmental Protection Agency, Washington, DC (USA)). Jun 1984. 125p. NTIS, PC A06/MF A01.

Color illustrations reproduced in black and white.

This report presents the Environmental Protection Agency's (EPA's) assessment of the progress we have made as a nation in improving the quality of the air we breathe, the water we depend on, and the land where we live. More importantly, it presents EPA's agenda for restoring and protecting these resources from past and future environmental hazards.

11190 **(PB—85-117034/XAB) Mobility of toxic compounds from hazardous wastes. Report for January 1982-December 1983.** Francis, C.W.; Maskarinec, M.P.; Goyert, J.C. (Oak Ridge National Lab., TN (USA)). Jul 1984. 279p. NTIS, PC A13/MF A01.

The objective of this research was to develop a laboratory extraction method for solid wastes that simulates concentrations of inorganic and organic constituents in leachates that result from co-disposing industrial wastes with municipal wastes in landfills (co-disposal in a landfill containing a 95:5 ratio of municipal to industrial waste, respectively). The intent was to produce a scientific rationale and a data base from which an extraction method can be selected to simulate leaching of solid wastes co-disposed with municipal wastes.

2904 Natural Resources

REFER ALSO TO CITATION(S) 29040011186

11191 **(ORNL—6026-Vol.1) Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 1. Management plan overview and summary.** (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 59p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85002109.

A plan for management of the resources of the Department of Energy's Oak Ridge Reservation has been developed to assist planners in the decision-making process. It contains information on all the resources of the Oak Ridge Reservation, natural, technical, and administrative, as well as recommendations for their continued management. A permanent resource management structure has been recommended to respond quickly to administrative needs and to coordinate and integrate the functions of the individual resource groups. Also, establishment of a computerized data base of numerical and graphical information has been initiated to provide a readily accessible source of up-to-date resource data. Recommendations in the plan include: (1) maintain and continuously update the computerized data base of resource information; (2) develop inventories for those resources where data is missing or incomplete; (3) create a special areas category for those resources needing special attention in future land-use decisions; (4) designate the Oak Ridge Reservation as a wildlife management area and appoint a full-time Tennessee Wildlife Resource Agency person as site representative; and (5) create a means for storage and cataloging of geologic core samples collected from the reservation. 12 references.

11192 **(ORNL—6026-Vol.2) Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 2, Appendix A: aquatic habitats.** Loar, J.M. (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 36p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85002110.

A diversity of aquatic habitats, ranging from undisturbed small streams to liquid waste disposal ponds, exist on the Department of Energy (DOE) Oak Ridge Reservation. The most important of these habitats may support populations of threatened or endangered aquatic species or provide sites for experimental ecological research. A management plan is proposed that will ensure the long-term preservation of these habitats by controlling various land-use practices in the watershed. The impacts associated with timber harvest and management practices can be minimized by careful planning of access roads to the harvest sites and by providing a narrow buffer strip of uncut trees and shrubs along the stream margins. Reservation streams should be surveyed to determine the presence of any threatened or endangered aquatic vertebrate species. If such species are found, their habitat should be designated a natural area within the Oak Ridge National Environmental Research Park. Resolution of conflicts over competing land-use practices will require careful planning in the early stages of project development, close coordination with forest management plans, and recognition of the long-term benefits that accrue when some watersheds remain in a undisturbed state. 28 references, 1 figure, 1 table.

11193 **(ORNL—6026-Vol.3) Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 3, Appendix B: archaeological considerations.** Sanders, M. (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 69p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85002107.

The Oak Ridge Reservation area is rich in archaeological resources, both prehistoric and historic. Preservation of these resources is mandated by several pieces of federal legislation and by the Tennessee Natural Areas Preservation Act of 1971. In deciding the future use of reservation lands, planners must consider the effects of expansion or new construction on the archaeological resources of the area. This document presents an overview of the anthropological background of the area, a review of the research conducted on the reconnaissance, and a summary of archaeological resources in specific plant areas. A quantity of supporting documentation is provided, including detailed inventories of the cemeteries, prehistoric sites, and historic sites in the reservation area. 29 references, 22 figures, 3 tables.

11194 **(ORNL—6026-Vol.4) Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 4, Appendix D: endangered and threatened plant species.** Parr, P.D. (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 29p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85002108.

Plant species considered endangered or threatened on the Department of Energy Oak Ridge Reservation were identified through a review of pertinent literature and evaluation of herbarium voucher specimens. Three of the species identified have been proposed for inclusion on the federal list as rare in Tennessee and twelve plant species are on the official Tennessee list of endangered and threatened plants. These rare plants should be given careful consideration in resource management and land-use planning. Protection of endangered and threatened species in their native habitats is considered the best method of ensuring their survival. In addition to habitat preservation, natural history studies of the rare species are important in determining the best habitat management procedures necessary to maintain the species. 18 references, 1 figure, 2 tables.

11195 **(ORNL—6026-Vol.5) Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 5, Appendix E: environmental monitoring.** Daniels, K.L. (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 55p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85002105.

Environmental monitoring data provide an invaluable resource for future planning efforts. This document describes the resource including the monitoring locations, frequency of sampling analysis, types of analyses performed, and database locations. Base maps and overlays are used to indicate existing environmental conditions on the Department of Energy (DOE) Oak Ridge Reservation (ORR). The plan summarizes future monitoring projects and the interaction of environmental monitoring responsibilities with other resource management plans. 10 references, 22 figures, 4 tables.

11196 **(ORNL—6026-Vol.6) Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 6, Appendix F: forest management.** Bradburn, D.M.; Rosenbalm, E.H. (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 110p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85001382.

The Forest Management Plan for the Department of Energy Oak Ridge Reservation is a guide for managing and administering forest resources. A newly revised plan summarizes goals and accomplishments of the previous plan and recommends management practices, improvements, and alternatives for the ensuing management cycle. This plan contains a summary of the Reservation's present (1981) timber volume by stratum in each of the 35 management compartments and recommends management treatments, cutting budgets, and silvicultural activities for the ensuing cycle. 10 references, 5 figures, 16 tables.

11197 **(ORNL—6026-Vol.7) Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 7, Appendix G: geography, demography, topography, and soils.** Petrich, C.H.; Manrod, W.E.; Barton, W.D.; Durfee, R.C.; Hines, J.F.; Tinnel, E.P. (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 74p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85000318.

The topography, geography, soils, and demography of the DOE Oak Ridge Reservation are discussed. Information is provided on the regional demographic and geographic setting of the Reservation as well as a discussion of the demography and geography of the particular plants. The geography sections discuss transportation links, manmade features, and their relationships to existing land forms. Discussions of the engineering properties of the reservation soils and of earth borrow sources are provided. The use of computer graphics is described and a plan to computerize mappable RMP data is presented. 8 references, 30 figures, 4 tables.

11198 **(ORNL—6026-Vol.8) Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 8, Appendix H: geology.** Butz, T.R. (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 41p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85001284.

The geology section of the Resource Management Plan for the Department of Energy Oak Ridge Reservation is a summary of geologic conditions and known mineral resources. The section provides information that, when merged with soil, topographic, and hydrologic data, will serve as a logical basis for future site selection. The geologic resources, which are industrial minerals, are identified by composition and availability. 15 references, 3 figures, 2 tables.

11199 **(ORNL—6026-Vol.9) Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 9, Appendix I: health, safety, and environmental affairs.** Speas, I.G. (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 42p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85000982.

Effective programs are in place to assure protection of onsite and offsite personnel, facilities, and the environment. These include provisions for safety review and documentation for all the facilities; programs for internal plant or laboratory health, safety, and environmental protection; environmental monitoring program for the Oak Ridge Reservation; maintenance of controlled perimeter buffer zones; and a mutual emergency aid agreement for all the Oak Ridge installations. These programs are coordinated and monitored on three organizational levels; by the health, safety, and environmental protection staffs of the individual installations; by the operating contractors's Office of Health, Safety, and Environmental Affairs; and by the DOE Oak Ridge Operations (ORO) Safety and Environmental Control Divison. 16 references, 7 figures, 4 tables.

11200 **(ORNL—6026-Vol.10) Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 10, Appendix J: hydrology.** Rothschild, E.R.; Smith, E.D.; Huff, D.D. (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 74p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85000980.

In the humid environment of the Department of Energy Oak Ridge Reservation (ORR), the hydrologic system is of major importance to the mobility and fate of contaminants, as well as the functioning of natural ecosystem processes. Because of its importance, the hydrologic system warrants careful utilization and management. The hydrologic regime on the Reservation, both ground and surface water, is controlled regionally by the Clinch River. The reservation is a net importer of water from the Clinch; hence water quantity for supply purposes is not of major concern. Water quality is the major concern of hydrologic management on the reservation, particularly in conjunction with waste management. Flooding can be important, but proper land use and construction practices will minimize economic losses. Controlled study areas, such as the Walker Branch watershed, are other valuable hydrologic assets of the Reservation. 25 references, 11 figures, 11 tables.

11201 (ORNL—6026-Vol.11) **Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 11, Appendix K: site development.** Chance, W.W.; Baumgardner, D.R. (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 76p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85001878.

When it was formed, DOE brought together under one program a vast variety of physical facilities, making it the second largest holder of property and facilities in civilian sector of the federal government. It is DOE's goal to use these facilities in civilian sector of the federal government. It is DOE's goal to use these facilities effectively in order to accomplish its mission efficiently. To carry out this mission site planning and management have been determined to be critical. DOE's Oak Ridge Reservation contains three major facilities: the Oak Ridge Gaseous Diffusion Plant (ORGDP), for enriching uranium; the Oak Ridge National Laboratory (ORNL), for energy research and development and defense; and the Oak Ridge Y-12 Plant (OR Y-12 Plant), for weapons production. Despite the short amount of time taken for development of these facilities, they have continued to expand and develop over the past 40 years to represent a current investment of over $3.1 billion in plant equipment. It has only been in the past few years that serious effort has been devoted to site planning, reflecting a change in thinking toward long-range planning and utilization of these permanent facilities. Other facilities that impact the resources and thus the planning for the reservation include the following: (1) the Demonstration Reprocessing Plant, part of the Consolidated Fuel Reprocessing Program; (2) the ELMO Bumpy Torus Proof-of-Principle device; (3) the Fusion Engineering Device; (4) the Waste Heat Utilization System; (5) the National Environmental Research Park; (6) the Comparative Animal Research Laboratory; (7) the Centralized Waste Storage Facility; and (8) the Synthetic Fuels Plant. 18 references, 20 figures, 3 tables.

11202 (ORNL—6026-Vol.12) **Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 12, Appendix L: laws, regulations, and guidelines.** Willis, L.F. (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 30p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85001269.

The report presents a general informative discourse on the major statutes and regulations respecting the environment, health and safety which impact the Oak Ridge Reservation. (AER)

11203 (ORNL—6026-Vol.13) **Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 13, Appendix M: Oak Ridge National Environmental Research Park.** Preston, E.L. (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 26p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85001268.

The Oak Ridge National Environmental Research Park (NERP) is one of five NERPs established to date under the policy of the Department of Energy (DOE) for the purpose of providing protected land areas for research and education in the environmental sciences and demonstration of the environmental compatibility of energy technology developments. The Oak Ridge NERP consists of 5,5000 ha of the Department of Energy Oak Ridge Reservation, Oak Ridge, Tennessee. The NERP lies in the heart of an eastern deciduous forest area of streams and reservoirs, mesic hardwood forests, and extensive upland mixed forests. Continuing characterization of the Oak Ridge NERP lands, which is supported by DOE funds, includes the collection of meteorological, geological, and hydrological data and a cataloging of terrestrial and aquatic fauna and flora. 11 references, 2 figures, 1 table.

11204 (ORNL—6026-Vol.14) **Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 14, Appendix O: utilities.** Daugherty, R.O. (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 62p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85001267.

This document provides data to support effective management of the utility and transportation systems serving the Department of Energy (DOE) Oak Ridge Reservation (ORR). The major surface, overhead, and underground utilities and the transportation systems are discussed and shown primarily for the ORR area outside plant perimeter fences. Details of individual plant utilities, streets, and railroads are available on master record drawings on file in each plant's engineering record center. This appendix identifies all of the major utility and transportation resources on the Reservation in a single document, heretofore only available from several sources. The major utilities serving the Reservation are electrical power, telecommunications, raw and treated water, natural gas, and sanitary sewers, Highways, access roads, and railroads are also included in this appendix because of the similar services they provide. 21 references, 6 figures, 2 tables.

11205 (ORNL—6026-Vol.15) **Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 15, Appendix P: waste management.** Kelly, B.A. (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 64p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85001876.

Since their inception, the DOE facilities on the Oak Ridge Reservation have been the source of a variety of airborne, liquid, and solid wastes which are characterized as nonhazardous, hazardous, and/or radioactive. The major airborne releases come from three primary sources: steam plant emissions, process discharge, and cooling towers. Liquid wastes are handled in various manners depending upon the particular waste, but in general, major corrosive waste streams are neutralized prior to discharge with the discharge routed to holding or settling ponds. The major solid wastes are derived from construction debris, sanitary operation, and radioactive processes, and the machining operations at Y-12. Nonradioactive hazardous wastes are disposed in solid waste storage areas, shipped to commercial disposal facilities, returned in sludge ponds, or sent to radioactive waste burial areas. The radioactive-hazardous wastes are treated in two manners: storage of the waste until acceptable disposal options are developed, or treatment of the waste to remove or destroy one of the components prior to disposal. 5 references, 4 figures, 13 tables.

11206 (ORNL—6026-Vol.16) **Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 16, Appendix Q: wildlife management.** Kitchings, J.T.; Story, J.D. (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 49p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85001696.

This document outlines a plan for management of the wildlife resources on the Department of Energy's Oak Ridge Reservation. The wildlife resources are divided into four management categories, each with a specific set of objectives and procedures for obtaining these objectives. These are (1) species-richness management to ensure that all resident wildlife species exist on the Reservation in viable numbers; (2) featured species management - to produce selected species in desired numbers on designated land units; (3) management of game species for research, education, and recreation; and (4) endangered species management designed to preserve and protect both the species and habitat critical to the survival of those species. Achievement of the objectives will be a joint effort between Oak Ridge National Laboratory Environmental Sciences Division staff, who have previous experience in wildlife projects, and members of the Tennessee Wildlife Resources Agency. 22 references, 2 figures, 5 tables.

11207 (ORNL—6026-Vol.17) **Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 17. Maps.** Chance, W.W.; Puett, J. (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 138p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE85001697.

This volume contains maps depicting various aspects, programs and facilities of the Oak Ridge Reservation. (ACR)

2905 Research, Development, Demonstration, And Commercialization

REFER ALSO TO CITATION(S) 29050010951, 11220, 11225, 11809

2906 Nuclear Energy

REFER ALSO TO CITATION(S) 29060011089

11208 **(DOE/ET/32041—T1) Energy and nuclear futures to 2025: an overview.** Rowen, B.; Rowen, H.S. (Pan Heuristics, Marina del Ray, CA (USA)). 22 Dec 1979. Contract AC01-79ET32041. 34p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85006459.

This report summarizes results from an explortion of the relationship between potential growth paths in nuclear energy and total energy usage in the world outside communist areas to the year 2025, and the relationship between nuclear energy and potential access to nuclear explosive materials also to the year 2025. In doing this, two analytic tools were devised: an energy-economic model and a sensitive materials stocks and flows model. In addition, systematic treatment has been given to the comparative costs of alternative nuclear fuel cycles which (partially) internalizes different proliferation risks and (also, partially) internalizes differences in security of nuclear fuel supply, i.e. puts them on a more nearly comparable cost basis. Finally, this study explores the potential growth to the year 2025 in the number of countries likely to have the economic and industrial resources for at least modest nuclear weapons capabilities. 2 figures, 5 tables.

11209 **(EDP—29) Nuclear power in the Western World to 2020.** Evans, N. (Cambridge Univ. (UK). Cavendish Lab.). 16 Sep 1983. 65p. Energy Research Group, Dept. Physics, Cavendish Lab., Univ. Cambridge, Cambridge CB3 0HE, price Pound 6.00 (GB), Pound 8.50 (overseas).

In this report is presented a current view of the likely growth of nuclear power in the Western World to 2020. The results of the study indicate that the high nuclear growth rates predicted in the mid-1970s were far too optimistic. In the majority of countries which looked to nuclear power in the years following the first oil price rise of 1973, programmes for nuclear expansion have been reduced as a result of falling electricity demand, escalating costs and technical problems. In some cases the nuclear option has been abandoned completely. To the end of the century nuclear capacity estimates, made on a country-by-country basis, reflect the general uncertainty regarding nuclear power now felt by many power utility planners. Within this general picture, exceptions emerge, however, France being the most notable. For the long-term it has been assumed that the contribution made by nuclear power to energy supply will increase, as pressures on fossil fuel prices grow and energy imports become a major barrier to economic growth. However, this is not a sanguine pro-nuclear picture, as a great deal of uncertainty in the estimates is admitted, and it is acknowledged that some countries will continue to reject nuclear power. Rather, it is believed to be a pragmatic view of the future which attempts to address the problems that constraints on energy inevitably bring, while recognising the economic, social and institutional difficulties that are a peculiar feature of this particular source of energy.

2907 Transport And Storage

REFER ALSO TO CITATION(S) 29070011214

11210 **(DOE/PE/06322—T1) Disaggregating regional energy supply/demand and flow data to 173 BEAs in support of the national energy transportation study. Final report.** (TERA, Inc., Arlington, VA (USA)). 31 Dec 1979. Contract AC01-78PE06322. 199p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE85005386.

In July 1978, TERA, Inc. was awarded a contract by the US Department of Energy, Office of Policy and Evaluation, to undertake a study of the National Energy Transportation System. TERA's role was specified to be the development and implementation of a methodology to disaggregate national energy supply and demand scenarios provided by DOE for 1985, 1990, and 1995 into detailed supply and demand forecasts at the Bureau of Economic Analysis (BEA) regional level. In addition, TERA was to be responsible for the development and implementation of a rational methodology for estimating interregional flows of energy materials from each BEA producing region to each BEA consuming region in the country. For oil and coal, these flows were to be estimated for a number of different transportation modes. Given these Origin-Destination Flows as starting points, a DOT network model was then to be used to estimate total energy and non-energy commodity transportation demand for each mode in an attempt to identify locations where transportation bottlenecks could appear. DOE additionally requested in February 1979, that TERA provide a detailed network analysis of potential bottlenecks in the natural gas transportation network. Finally, TERA was required to apply the foregoing methodology to seven DOE-selected scenarios of national supply and demand in order to produce detailed supply, demand, and origin-destination flow forecasts. The models developed suggested reasonable transport capacity for coal and oil in 1990 and 1995; the need for additional natural gas pipelines and their locations were also developed.

2908 Waste Heat Utilization

REFER ALSO TO CITATION(S) 29080011274

2910 Conservation

REFER ALSO TO CITATION(S) 29100011011, 11217, 11294

11211 **Industrial energy efficiency reporting: a bridge to information transfer.** Williams, T.E. (Office of Industrial Programs, U.S. Department of Energy, Washington, DC 20585). pp 949-952 of Energy Developments: New forms, renewables, conservation. Ontario, Canada; Pergamon Press (1984). (CONF-840506—).

From 2. international energy exposition and conference - ENERGEX '84; Regina, Canada (14 May 1984).

In the last decade, individual companies and industries in the United States have made great advances in reducing their energy costs and improving energy efficiency. But, with each company and industry acting on its own, there is still a need for monitoring and analysis of energy conservation trends across all manufacturing industries, in order to make each industry aware of what is happening in other sectors and to ensure open communication between government and industry in the setting of energy conservation policy. The Industrial Energy Efficiency Improvement Program, administered by the U.S. Department of Energy, has been in existence since 1976. Each year, approximately 600 manufacturing sector companies submit data on energy efficiency improvement and fuel-specific energy use to the program.

11212 **The institutional Conservation Program: a success story.** Johnson, K.G. (State and Local Conservation Programs Division, U.S. Department of Energy, Chicago Operations Office). pp 871-878 of Energy Developments: New forms, renewables, conservation. Ontario, Canada; Pergamon Press (1984). (CONF-840506—).

From 2. international energy exposition and conference - ENERGEX '84; Regina, Canada (14 May 1984).

The Institutional Conservation Program (ICP) is a voluntary grant program to help nonprofit institutions--schools, hospitals, local governments and public care facilities-save energy. This paper presents: A program overview, including legislative authority, elements of the program, funding, and accomplishments; The results of evaluations conducted for the Department of Energy (DOE), and independently, to determine the success of ICP in achieving its goals; Typical case studies in the Midwest. A review and evaluation of Midwest building data obtained from computerized management information system; An overview of innovative financing for schools and financial planning for energy efficient investments.

2920 Supply, Demand, And Forecasting

REFER ALSO TO CITATION(S) 29200010947

2930 Policy, Legislation, And Regulation

REFER ALSO TO CITATION(S) 29300010945, 10948, 11184, 11188, 11202, 11614, 11627

11213 **(PB—85-112811/XAB) Effects of oil deregulation on public transportation. Final report.** Bloch, A.J. (Polytechnic Inst. of New York, Brooklyn (USA). Transportation Training and Research Center). Aug 1984. 176p. NTIS, PC A09/MF A01.

This work is concerned with the Federal oil deregulation of petroleum prices and supplies on public-transportation systems and the effects of deregulation on the vulnerability of transit systems to future oil-supply disruptions. This work has two related objectives: (1) to analyze the full range of uncertainty that oil deregulation has created for public-transit systems in the event of another oil disruption and (2) the identification of six alternative methods of reducing this uncertainty for transit systems and the evaluation of these alternatives against three separate groups of criteria involving the breadth, cost, and institutional impacts of each. The six options for reducing uncertainty are: (1) continuation of current fuel-procurement procedures; (2) federally-mandated 100% allocation of supplies to transit systems; (3) use of the federally-controlled Strategic Petroleum Reserve in a general release or a directed sales format; (4) state set-aside fuel allocation to transit systems; (5) new fuel-procurement procedures; and (6) emergency assistance measures. The three groups of criteria are the: (1) uncertainty criteria; (2) transit service criteria; and (3) secondary impact criteria.

2940 Fossil Fuels

REFER ALSO TO CITATION(S) 29400010879, 10930, 10941, 10946, 10947, 10948, 10951

11214 **(CONF-8404201—3) Rail coal transportation under the Staggers Act.** Carpenter, A.R. (Chessie System, Inc., Cleveland, OH (USA)). 1984. 10p. University of Kentucky, 112 Frazer Hall, Lexington, KY. File Number TI85900890.

From 23. annual Kentucky industrial coal conference; Lexington, KY, USA (11 Apr 1984).

The Stagger's Act of 1980 offered railroads the opportunity to accelerate growth along with the coal industry in efforts to increase market for both the product (coal) and the service provided. It provides for cost recovery indexing allowing railroads to stay abreast of inflation and flexibility in setting and changing rates. It also allows railroads to enter directly into contract agreements with shippers. Railroads have used extreme caution in implementing these liberties so that the coal industry would not be severely impacted by these changes. They could have raised rates by as much as 52.3% under the new guidelines, but only raised them by 31.6% in the Eastern market and by 21.3% for export coal. The president of CSX Railroads stresses the symbiotic relationship existing between railroads and the coal industry. He suggests that separate sectors of the coal industry stop pointing fingers at one another and join hands to solve coal's competitive problems in the overseas export market. He calls for the formation of a blue-ribbon panel representing all of the parties with a stake in coal to implement such a cooperative effort. (DMC)

11215 **(NERDDP-CS—82-5) Overview study to identify the potential contribution of technologies to energy conservation in Australian industry.** (National Energy Research, Development and Demonstration Council, Canberra (Australia)). 1982. 208p. National Energy Research, Development and Demonstration Council, Canberra, Australia.

A study was carried out to identify the potential contribution of technologies to energy conservation and substitution in Australian manufacturing and processing industry. The primary objective was to identify those industries and technologies which should be the target of the Government's energy conservation R, D and D programme. Secondary objectives were to assess existing overseas and Australian technological approaches to industrial energy conservation management and to survey the views of private industry, research institutions and other agencies on the needs and opportunities for Government funded R, D and D of industrial energy conservation technologies. These various study tasks were undertaken to determine directions for particular future studies of industrial energy conservation management and to identify where more detailed analysis of industries and technologies is necessary for the development of sound energy conservation R, D and D programmes.

11216 **(NP—5900363) Indonesian oil and gas.** Mlotok, P. (Salomon Bros., Inc., New York (USA)). Oct 1984. 15p. Salmon Brothers Inc., One New York Plaza, New York, NY 10004. File Number TI85900363.

Indonesia is the major oil-producing nation in the Far East and is the only member of OPEC from that region. Private oil companies participate in the oil industry there as contractors with responsibility for exploration and production operations. Indonesia has been politically stable since the mid-1960s, and economic progress, based largely on oil revenues, has been impressive. While the recent decline in oil revenues has caused difficulties, fiscal adjustments have been made to prevent serious disruptions. Although Indonesia's foreign debt of $25 billion is large, the country has not yet had any problem servicing this debt. The country's current oil-producing capacity is 1.6 million barrels per day (mmb/d) and its gas-producing capacity is 3.0 trillion cubic feet per day (tcf/d). All gas exports move as Liquefied Natural Gas. Indonesia's OPEC oil quota is 1.3 mmb/d; it also produces 0.1 mmb/d of condensates. Nearly all of the oil and gas operations are managed by foreign companies under production-sharing contracts (PSC), which allow the contractor a profit equal to about 15% of after-cost revenues on oil and 35% on gas. We estimate current profits to be in the range of $3 to $4 per barrel on oil and $1.25 per thousand cubic feet (mcf) on gas. The PSC also allows recovery of exploration expenses from first production, so capital exposure is reduced and return on capital is generally attractive. Among the international oil companies, the major players in Indonesia are Chevron and Texaco (through their jointly owned Caltex subsidiary), and Mobil Oil (through wholly owned Mobil Oil Indonesia). The Indonesian political environment is currently stable and we do not expect any major changes in the terms of existing operations. Longer term, we would not be surprised to see Indonesia take a larger role in exploration and production through its national oil company, Pertamina, or through Indonesian-owned private companies. 4 figures.

2960 Electric Power

REFER ALSO TO CITATION(S) 29600011089, 11307, 11315

11217 (BNL—51748, pp 210-220) **Cost-based rates and other conservation options for electric utilities.** Leigh, R.W. (Brookhaven National Lab., Upton, NY). 1983. NTIS, PC A14/MF A01. File Number DE84017244. (CONF-830365—).

From Seminar on energy efficiency and conservation; Lome, Togo, Africa (30 Mar 1983).

Rapidly rising demand and severe financial constraints on construction are placing many electric utilities in developing countries in severe binds. Several conservation alternatives are examined to see if under certain ideal circumstances, the growth of electrical demand can be curtailed for less than the cost of additional electricity. Since conservation choices are normally made by consumers, however, while new generating capacity is supplied by the utility, the options are often not explored in a logical way. Several such impediments to rational selection of the best mix of conservation and utility expansion options are explored and two approaches which will help to overcome them are developed. Several aspects of the cost of operating an electric utility are discussed. The loads served by the utility are described, first characterizing them by sector and structure, and delineating the impediments to conservation in each case. It was established that load growth can easily be curtailed at a cost of $0.08/kWh or less, or moved off-peak at a cost of $0.04/kWh or less. The options available to the utility for

promoting these cost-effective conservation measures, better rate design, and direct intervention to promote conservation are discussed.

11218 (TVA/PUB—85/5) Application of MINOS to a thermal ramping problem. Giles, J.E. (Tennessee Valley Authority, Norris (USA). Div. of Air and Water Resources). Jan 1983. 25p. NTIS, PC A02/MF A01. File Number DE85900880.

The ramp problem studied is this: for a given peak thermal load and successive decreasing thermal loads, determine the most economic generation levels at which the thermal units should operate. This problem was formulated as a nonlinear programming problem, using 1981 power conditions, and solved using the MINOS optimization software package (Murtagh and Saunders, 1977). A strategy for approximating these generation levels, based on the results of the MINOS solution, is then derived.

2980 Consumption And Utilization

REFER ALSO TO CITATION(S) 29800010947

11219 (CONF-841136—4) Residential energy consumption characteristics of minority population groups: trends in demand and patterns of use. South, D.W.; McDonald, J.F. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 24p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005022.

From 6. annual North American meeting of the International Association of Energy Economists; San Francisco, CA, USA (5 Nov 1984).

Some of the pertinent residential energy demand trends of selected minority and low-income households are discussed in this paper. Both consumption and expenditure patterns at the national and census region level are examined. The database used for this analysis is the Residential Energy Consumption Survey (RECS) covering the years 1978 to 1981. The housing stock and household characteristics that could explain these trends and patterns are cited where appropriate; the structural characteristics of the underlying demand, however, are a topic for another paper. Some of the implications of these minority group energy use patterns and trends on energy demand modeling conclude the paper. 9 references, 8 tables.

2990 Unconventional Sources And Power Generation

REFER ALSO TO CITATION(S) 29900011011

11220 (DOE/CS/10118—T1-Vol.1) Appropriate Technology Small Grants Program: an evaluation. Volume I. Report. Wolcott, D.R.; Dierker, J.L.; Duesterberg, T.J.; Reynolds, P.S. (International Business Services, Inc., Washington, DC (USA)). Apr 1981. Contract AC01-80CS10118. 136p. NTIS, PC A07/MF A01; GPO Dep. File Number DE85005076.

This report evaluates the first year's operation of the Small Grants Program at a national scale. The purpose of this management evaluation is to provide the headquarters Office of Inventions and Small Scale Technology and the ten regional program managers with findings and recommendations which will be useful to more effectively administer the program in the future. A total of $7.95 million were awarded in grants for projects involving solar, biomass, geothermal, wind, hydro, and energy conservation technologies as well as related educational activities. The body of this report presents a description of the grants program, the findings of the evaluation, recommendations that have been made, and further questions which need to be asked. The following are the major conclusions of this report listed in relative order of importance. The inadequacy of current funding levels jeopardize the success of this program. Appropriation of $20 million is required to fulfill the mission required by the Public Law which created it. A careful balance must be maintained for the proportion of funds which are used for administrative expenses as opposed to grant awards. A counterproductive tension exists in the administration of the program between the national and regional/state levels. A number of legal issues surrounding the grants program have remained unresolved. Some of these issues have fundamental implications regarding patent rights, taxable income, and property rights. Basic inadequacies exist in terms of the personnel who administer this program. Twice the existing number of people are required at both headquarters and regional offices to effectively manage the program. Regional program managers have difficulties assigning priorities to technical as opposed to social/community goals of the program. 25 tables.

11221 (DOE/CS/10118—T1-Vol.2) Appropriate Technology Small Grants Program: an evaluation. Volume II. Appendix. Wolcott, D.R.; Dieker, J.L.; Duesterberg, T.J.; Reynolds, P.S. (International Business Services, Inc., Washington, DC (USA)). Apr 1981. Contract AC01-80CS10118. 103p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85005077.

The first year's operation of the Small Grants Program at a national scale was evaluated. A total of $7.95 million was awarded in grants for projects involving solar, biomass, geothermal, wind, hydro, and energy conservation technologies as well as related educational activities. The purpose of this management evaluation is to provide the headquarters Office of Inventions and Small Scale Technology and the ten regional program managers with findings and recommendations which will be useful to more effectively administer the program in the future. These conclusions are based on responses to a questionnaire from 197 program participants as well as personal interviews and telephone conversations with roughly half of the respondents. This volume contains 4 appendices. The survey instrument is described. The questions and answers are recorded. A compilation of computer-coded responses is also presented.

11222 (DOE/CS/10118—T2) Appropriate Technology Small Grants Program. Code case studies. (International Business Services, Inc., Washington, DC (USA)). May 1981. Contract AC01-80CS10118. 70p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85005078.

The first year's operation of the Small Grants Program at a national scale was evaluated. The purpose of this management evaluation is to provide the headquarters Office of Inventions and Small Scale Technology and the ten regional program managers with findings and recommendations which will be useful to more effectively administer in the future. These conclusions are based on responses to a questionnaire from 197 program participants as well as personal interviews and telephone conversations with roughly half of the respondents. This report presents a compilation of case studies of projects which were funded during FY 78 and FY 79. These case studies focus on code issues (e.g., building, zoning, planning) that grantees may have dealt with. Possible problems that may have been encountered and resolution actions that grantees may have taken were researched. The results are presented in the form of a brief discussion of code issues followed by the case studies of relevant projects. The technological areas of interest are: Utility interconnection case studies, grants in which electric power is produced by small scale wind and hydroelectric facilities and for which interconnection with a utility grid is possible; Biomass case studies, grants involving composting and small scale methane production; and Geothermal case studies, grants in which either groundwater or the earth's thermal energy is used as a source for heating and cooling. Each case study provides a brief overview of a grantee's project including its objective, description, and benefits.

11223 (DOE/SF/11647—T1) Biomass energy options for the American Territories of the Pacific. Brewbaker, J.L.; MacDicken, K.G. (eds.). (Hawaii Univ., Honolulu (USA)). Nov 1982. Contract AT03-82SF11647. 79p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85005419.

The term American Territories of the Pacific was used in this report as a general descriptor for the American Territories of Guam, American Samoa and the Trust Territories of the Pacific Islands (TTPI). These islands represent an especially challenging opportunity to develop small to medium scale biomass energy options. They depend on imported petroleum for nearly all of their energy needs. Its high cost, the lack of available and appropriate technologies, insular climatic conditions, and projected energy requirements urge emphasis on biomass options in this region. Successful

biomass options must be designed with consideration of site specific factors such as: periodic storms (about every decade) with winds of up to 320 kph (200 mph) and regular, annual storms with wind speeds in excess of 110 kph (80 mph); the critical lack of technically skilled labor; high construction costs and logistics problems; and difficult terrain and often nutrient depleted soils. The biomass energy resources of the American Territories of the Pacific have not been thoroughly studied. Thus, the choice of feedstock species, projections of yield, and costs per unit of harvested biomass cannot be made confidently. As a result, the costs to consumers of delivered energy are especially prone to inaccuracy. It is apparent nonetheless that biomass is an abundant, highly productive, and versatile renewable energy resource in Pacific Islands, and that its practical application must be preceded by adequate research and demonstration. Some specific recommendations are included. 34 references, 7 figures, 12 tables.

11224 **(OTA-BP-F—27) Technology, renewable resources, and American crafts: background paper.** (Office of Technology Assessment (U.S. Congress), Washington, DC). May 1984. 57p. GPO*. File Number TI85900347.

Technology's effects on craftworkers and craft supplies are variable and sometimes inequitable. Traditional craftspeople more often are adversely affected by technological change; contemporary craftworkers more often benefit. US concern is increasing about diminishing renewable resource availability for crafts - and the concern appears justified. Precise data on the types and amount of resources involved are lacking; it may be several years before better data are available and compiling that data will be difficult. Undertaking a full-scale assessment of technology, renewable resources, and crafts seems unwarranted now. Development of more consistent Federal policies for managing renewable resources while supporting crafts need not await more information.

11225 **Geothermal research and development activities of the U.S. Department of Energy.** La Sala, R. (Program Manager, Conversion Technology, Geothermal & Hydropower Technology Division, U.S. Department of Energy). pp 243-248 of Proceeding of the 5th New Zealand Geothermal Workshop 1983. Auckland, New Zealand; Geothermal Inst., Univ. of Auckland (1983). (CONF-8311199—).

From 5. New Zealand geothermal workshop; Auckland, New Zealand (9 Nov 1983).

The last few years have brought substantial changes in the US Government's energy programs. This has resulted in a shift away from "commercialization" and a reduction in the geothermal R & D budget, consistent with the administration's policy of reducing interference in the free market and reducing Federal deficits. An R & D review conducted for DOE last year concluded that Federal R & D on generation of electricity from geothermal resources has been too heavily funded in the past. It predicted that geothermal energy will have a low impact on national energy supply and stated that if a Federal geothermal program is continued, emphasis should be on low temperature process heat and the completion of the hot dry rock program; not on geopressured resource development, where the technical risk appears high, or on hydrothermal electric generation, where industry is capable of solving the remaining problems. These recommendations seem to have been only partially adopted. The DOE strategy now is to support research that will result in a broad technology base for use by the private sector.

30 DIRECT ENERGY CONVERSION

3005 Fuel Cells

11226 **(CONF-831104—3) Monolithic fuel cells.** Fee, D.C.; Steunenberg, R.K.; Claar, T.D.; Poeppel, R.B.; Ackerman, J.P. (Argonne National Lab., IL (USA)). 13 Nov 1983. Contract W-31-109-ENG-38. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005050.

From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

A new fuel cell technology is being developed at Argonne National Laboratory. This new design concept, called the monolithic fuel cell, has roughly 100 times the power density of conventional fuel cells. The design employs the thin ceramic layer components of existing solid oxide fuel cells in a strong, lightweight honeycomb structure of small cells, and so achieves unequaled power per unit mass or volume. The monolithic fuel cell will convert hydrocarbon fuel to dc power at 50% efficiency, and thus attains considerably higher energy densities than other technologies that use non-exotic fuels. In the monolithic concept, fuel and air are combined electrochemically in a ceramic cell at an operating temperature of 1100 to 1300°K. Cell components are fabricated as one piece much like a block of corrugated paperboard. Fuel and oxidant are conducted through alternating passages in the structure. These passages are formed from thin (25 to 100 micrometer) layers of the active cell components: the anode, cathode, electrolyte, and an interconnection material which serves to connect cells in electrical series (bipolar plate). The corrugations also form the gas seal at the edges of the structure.

11227 **(CONF-831104—Summs.) 1983 national fuel cell seminar. Program and abstracts.** (Courtesy Associates, Inc., Washington, DC (USA)). 1983. 191p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE84015345.

From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

Separate entries were made in the data base for the 47 short papers and summaries included. (WHK)

11228 (CONF-831104—Summs., pp 1-5) **Acid fuel cell technology: an overview.** Appleby, A.J. (Electric Power Research Institute, Palo Alto, CA). 1983. NTIS, PC A09/MF A01. File Number DE84015345.

From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11229 (CONF-831104—Summs., pp 6-10) **Molten carbonate fuel cells: development status.** Pierce, R.D.; Ackerman, J.P. (Argonne National Lab., IL). 1983. NTIS, PC A09/MF A01. File Number DE84015345.

From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11230 (CONF-831104—Summs., pp 11-14) **Solid oxide fuel cells.** Fee, D.C.; Ackerman, J.P. (Argonne National Lab., IL). 1983. NTIS, PC A09/MF A01. File Number DE84015345.

From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11231 (CONF-831104—Summs., pp 15-17) **Integrated energy systems for buildings.** Buchanan, W.; Kaufman, A.; Pudick, S.; Wang, C.L.; Werth, J.; Whelan, J.A. (Engelhard Corp., Menlo Park, Edison, NJ). 1983. NTIS, PC A09/MF A01. File Number DE84015345.

From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11232 (CONF-831104—Summs., pp 19-22) **Energy conservation by on-site fuel cells.** Madariaga, H.A. (Southern California Gas Co., Los Angeles). 1983. NTIS, PC A09/MF A01. File Number DE84015345.

From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11233 (CONF-831104—Summs., pp 23) **Progress in on-site fuel cell technology development.** King, J.M. (United Technologies Corp., South Windsor, CT). 1983. NTIS, PC A09/MF A01. File Number DE84015345.

From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11234 (CONF-831104—Summs., pp 25-31) **Techno-economic evaluation of a direct fuel cell system.** Bharvani, R.; Matsumura, M.; Patel, P.S. (Energy Research Corp., Danbury, CT; Fluor Engineers Inc., Irvine, CA; Mitsubishi Electric Corp., Amagasaki Hyogo, Japan). 1983. NTIS, PC A09/MF A01. File Number DE84015345.
From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11235 (CONF-831104—Summs., pp 32-37) **Component development for direct fuel cell.** Paetsch, L.; Pigeaud, A.; Maru, H.C. (Energy Research Corp., Canbury, CT). 1983. NTIS, PC A09/MF A01. File Number DE84015345. Contract AC02-76ET11304.
From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11236 (CONF-831104—Summs., pp 38-40) **Status of molten carbonate fuel cell development at United Technologies Corporation.** Meyer, A.P.; Reiser, C.A.; Kunz, H.R.; Schroll, C.R. (United Technologies Corp., South Windsor, CT). 1983. NTIS, PC A09/MF A01. File Number DE84015345.
From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11237 (CONF-831104—Summs., pp 42-45) **Stable materials for molten carbonate fuel cell cathodes.** Smith, J.L.; Kaun, T.D.; Minh, N.Q.; Pierce, R.D. (Argonne National Lab., IL). 1983. NTIS, PC A09/MF A01. File Number DE84015345.
From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11238 (CONF-831104—Summs., pp 46-50) **Molten carbonate fuel cell component development.** Camara, E.H.; Ong, E.T. (Inst. of Gas Tech., Chicago, IL). 1983. NTIS, PC A09/MF A01. File Number DE84015345.
From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11239 (CONF-831104—Summs., pp 51-54) **4.8-megawatt demonstrator. Progress report.** Gelfond, L. (Consolidated Edison Co., New York, NY). 1983. NTIS, PC A09/MF A01. File Number DE84015345.
From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11240 (CONF-831104—Summs., pp 55) **4.5 MW fuel cell power plant test at Tokyo Electric Power Company.** Kobayashi, M. (Tokyo Electric Power Co., Inc., Japan). 1983. NTIS, PC A09/MF A01. File Number DE84015345.
From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11241 (CONF-831104—Summs., pp 56-58) **Electric utility PAFC technology development progress.** Lee, J.M. (United Technologies Corp., South Windsor, CT). 1983. NTIS, PC A09/MF A01. File Number DE84015345.
From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11242 (CONF-831104—Summs., pp 59-60) **Westinghouse fuel cell power plant design.** Newby, D. (Westinghouse Electric Corp., Pittsburgh, PA). 1983. NTIS, PC A09/MF A01. File Number DE84015345.
From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11243 (CONF-831104—Summs., pp 61-69) **Fuel motivated approach to fuel cell application.** Griswold, J.W.; Wilborn, J. (Southern California Edison, Rosemond, CA). 1983. NTIS, PC A09/MF A01. File Number DE84015345.
From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11244 (CONF-831104—Summs., pp 70-73) **Assessment of options for small-scale lignite fueled cogeneration plants.** Grisso, J.R. (Ralph M. Parsons Co., Pasadena, CA). 1983. NTIS, PC A09/MF A01. File Number DE84015345.
From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11245 (CONF-831104—Summs., pp 74-77) **Monolithic fuel cells.** Fee, D.C.; Steunenberg, R.K.; Claar, T.D.; Poeppel, R.B.; Ackerman, J.P. (Argonne National Lab., IL). 1983. NTIS, PC A09/MF A01. File Number DE84015345.
From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11246 (CONF-831104—Summs., pp 78-81) **Advancing from single cell technology to generator engineering: A SOFC status report.** Isenberg, A.O. (Westinghouse Electric Co., Pittsburgh, PA). 1983. NTIS, PC A09/MF A01. File Number DE84015345. Contract AC02-80ET17089.
From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11247 (CONF-831104—Summs., pp 82-83) **Computer-based fuel cell analytical tools: description and availability.** Zeh, C.M.; Gmeindl, F.D.; Bajura, R.A. (US DOE Morgantown Energy Technology Center, WV). 1983. NTIS, PC A09/MF A01. File Number DE84015345.
From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11248 (CONF-831104—Summs., pp 84) **Computer model of UTC 11-MW fuel cell power plant.** Rentz, R.L.; Hira, A.U.; Parker, A.J.; Moore, J.S. (Mueller Associates, Inc., Baltimore, MD). 1983. NTIS, PC A09/MF A01. File Number DE84015345.
From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11249 (CONF-831104—Summs., pp 85-88) **PSI: mechanistic fuel cell modeling.** Wilemski, G.; Gelb, A. (Physical Sciences Inc., Andover, MA). 1983. NTIS, PC A09/MF A01. File Number DE84015345.
From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11250 (CONF-831104—Summs., pp 89) **Potential fuel cell application in the metallurgical industries.** Jones, M.S. Jr. (EBASCO Services Inc., Santa Ana, CA). 1983. NTIS, PC A09/MF A01. File Number DE84015345.
From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11251 (CONF-831104—Summs., pp 91-92) **Fuel cells for chlor-alkali plants.** Anderson, J.M.; Joiner, J.R.; Maru, H.C. (PPG Industries, Inc., Pittsburgh, PA). 1983. NTIS, PC A09/MF A01. File Number DE84015345.
From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11252 (CONF-831104—Summs., pp 93-95) **Development of fuel cell technology for industrial applications.** Tajima, H.; Kaneko, H. (Fuji Electric Corporate Research and Development Ltd., Yokosuka, Japan; Fuji Electric Co., Kawasaki, Japan). 1983. NTIS, PC A09/MF A01. File Number DE84015345.
From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11253 (CONF-831104—Summs., pp 96-97) **Development of PAFC system and its application to industrial use.** Kishida, K.; Nishiyama, E.; Hamasaki, Y. (Mitsubishi Electric Corp., Amagasaki, Japan; Mitsubishi Electric Corp., Kobe, Japan). 1983. NTIS, PC A09/MF A01. File Number DE84015345.

From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11254 (CONF-831104—Summs., pp 98-102) **OXY hydrogen-air fuel cell.** Emery, A.T. (Occidental Chemical Corp., Niagara Falls, NY). 1983. NTIS, PC A09/MF A01. File Number DE84015345.

From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11255 (CONF-831104—Summs., pp 103-105) **Performance characteristics of solid oxide fuel cells.** Hoover, D.Q.; Jones, A.R. (Westinghouse Electric Corp., Pittsburgh, PA). 1983. NTIS, PC A09/MF A01. File Number DE84015345. Contract AC02-80ET17089.

From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11256 (CONF-831104—Summs., pp 107-110) **NASA fuel cell applications for space.** Sheibley, D.W.; Denais, J.D.; Murgia, L.S. (NASA Lewis Research Center, Cleveland, OH; NASA Johnson Space Center, Houston, TX). 1983. NTIS, PC A09/MF A01. File Number DE84015345.

From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11257 (CONF-831104—Summs., pp 111-114) **Small methanol powerplant progress.** Abens, S.; Farooque, M.; Schneider, T. (Energy Research Corp., Danbury, CT). 1983. NTIS, PC A09/MF A01. File Number DE84015345.

From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11258 (CONF-831104—Summs., pp 115-117) **Fuel cell power system for forklift trucks.** Brand, M.J.; Early, J.J.; Kaufman, A.; Stawsky, A.; Werth, J. (Engelhard Corp., Iselin, NJ). 1983. NTIS, PC A09/MF A01. File Number DE84015345.

From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11259 (CONF-831104—Summs., pp 118-122) **Carbon monoxide tolerant anodes and freeze resistant electrodes.** Adams, A.A.; Coleman, A.J.; Joyce, L.S. (US Army Mobility Equipment Research and Development Command, Fort Belvoir, VA). 1983. NTIS, PC A09/MF A01. File Number DE84015345.

From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11260 (CONF-831104—Summs., pp 123-126) **Status of solid polymer electrolyte fuel cell technology.** McElroy, J.F. (General Electric Co., Wilmington, MA). 1983. NTIS, PC A09/MF A01. File Number DE84015345.

From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11261 (CONF-831104—Summs., pp 127-130) **Advanced electrocatalysts and supports for phosphoric acid fuel cells.** Jalan, V.; Taylor, E.J.; Frost, D.; Morrisseau, B. (Giner, Inc., Waltham, MA). 1983. NTIS, PC A09/MF A01. File Number DE84015345.

From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11262 (CONF-831104—Summs., pp 131-134) **Electrochemical and surface science research on fuel cells.** Srinivasan, S.; Hyde, P.J.; Carubelli, A.; Paffett, M.T.; Derouin, C.R.; Bobbett, R.E.; Campbell, C.T.; Maggiore, C.J.; Taylor, T.N.; Gonzalez, E.R. (Los Alamos National Lab., NM). 1983. NTIS, PC A09/MF A01. File Number DE84015345.

From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11263 (CONF-831104—Summs., pp 135-140) **Carbon corrosion in hot phosphoric acid fuel cells.** Stonehart, P.; MacDonald, J.P. (Stonehart Associates, Madison, CT). 1983. NTIS, PC A09/MF A01. File Number DE84015345.

From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11264 (CONF-831104—Summs., pp 141-144) **Advanced electrolytes for acid fuel cells: an overview.** Ross, P.N. Jr. (Lawrence Berkeley Lab., CA). 1983. NTIS, PC A09/MF A01. File Number DE84015345. Contract AC03-76SF00098.

From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11265 (CONF-831104—Summs., pp 145-148) **Overview of fuel cell development under the Moonlight Project.** Ogura, Y.; Itoh, N. (Ministry of International Trade and Industry, Tokyo, Japan; New Energy Development Organization, Tokyo, Japan). 1983. NTIS, PC A09/MF A01. File Number DE84015345.

From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11266 (CONF-831104—Summs., pp 149-152) **R and D of phosphoric acid fuel cell technologies and systems for a dispersed power plant.** Kishida, K.; Anahara, R. (Mitsubishi Electric Corp., Amagasaki, Japan; Fuji Electric Co., Tokyo, Japan). 1983. NTIS, PC A09/MF A01. File Number DE84015345.

From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11267 (CONF-831104—Summs., pp 153-156) **High pressure type PAFC development for concentrated generation.** Akimaru, S.; Tsutsumi, Y.; Tamura, K.; Ono, S.; Ogimoto, K.; Sakamoto, K.; Masunaga, N. (Hitachi Ltd., Tokyo, Japan; Toshiba Corp., Tokyo, Japan). 1983. NTIS, PC A09/MF A01. File Number DE84015345.

From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11268 (CONF-831104—Summs., pp 157-160) **Development of 50 kW fuel cell power plant.** Sakai, T.; Tsukamoto, K.; Saito, R.; Ide, M. (Sanyo Electric Co., Ltd., Osaka, Japan). 1983. NTIS, PC A09/MF A01. File Number DE84015345.

From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11269 (CONF-831104—Summs., pp 161-164) **Status of Japanese molten carbonate fuel cell program.** Kodama, T.; Tamura, K.; Murata, K.; Horiuchi, N. (Government Industrial Research Inst., Ikeda-shi, Japan; Hitachi Ltd., Hitachi-shi, Japan; Toshiba Research and Development Center, Kawasaki-shi, Japan; Center Research Institute of Electric Power Industry, Tokyo, Japan). 1983. NTIS, PC A09/MF A01. File Number DE84015345.

From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11270 (CONF-831104—Summs., pp 165-168) **Development of high temperature solid electrolyte fuel cell at electrotechnical laboratory.** Nagata, S.; Ohno, Y.; Kasuga, Y.; Sato, H. (Electrotechnical Lab., Ibaraki, Japan). 1983. NTIS, PC A09/MF A01. File Number DE84015345.

From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11271 (CONF-831104—Summs., pp 169-172) **Operational experiences of 30 kW phosphoric acid fuel cell power plant.** Yonehara, M.; Anahara, R.; Suzuki, K. (Kansai Electric Power Co., Inc., Hyogo-ken, Japan; Fuji Electric Co., Tokyo, Japan, Fuji Electric Corporate Research and Development Ltd., Kanagawa-ken, Japan). 1983. NTIS, PC A09/MF A01. File Number DE84015345.

From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11272 (CONF-831104—Summs., pp 173-176) **Applications of fuel cell power plants in Japanese utility use.** Horiuchi, N.; Itoh, N.; Takeshita, S. (Central Research Inst. of Electric Power Industry, Tokyo, Japan; New Energy Development Organization, Tokyo, Japan; Institute of Applied Energy, Tokyo, Japan). 1983. NTIS, PC A09/MF A01. File Number DE84015345.

From National fuel cell seminar; Orlando, FL, USA (13 Nov 1983).

11273 **(DOE/ET/15440—19) Development of molten carbonate fuel cell power plant technology. Quarterly technical progress report No. 19, April 1-June 30, 1984.** (United Technologies Corp., South Windsor, CT (USA)). Sep 1984. Contract AC21-79ET15440. 142p. (FCR—6523). NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE84016839.

The overall objective of this program is to develop and verify the design of a prototype molten carbonate fuel cell stack which meets the requirements of a 1990's-competitive, coal-fired, electrical utility central station, or industrial cogeneration power plant. Progress is detailed. Compressive creep testing of the present anode continued; the samples have now accrued 1220 hours of testing at 1300°F and continue to support the earlier data showing improved creep resistance. Testing to define the operating limits that are suitable for extending the life of nickel oxide cathodes to an acceptable level is continuing. The mechanical characteristics of several one-piece cathode current collector candidates are being measured for suitability. Metallographic evaluation of stack separators tested for 2000 hours during the previous report period was initiated. Post-test characterization of surface treated INCO 825 that was tested for 1000 hours at 1400°F in a single cell test was completed. Retort corrosion testing of this material accumulated ~ 1500 hours of testing and is continuing. Potentiostatic immersion testing of alternative single piece cathode current collector materials was initiated. The 20-cell Stack No. 3 progressed from completion and delivery of the Test Plan through Design Review, assembly, and initial heat-up for the start of testing. Manufacture of separator plates for the upcoming 20-cell Stack No. 4 has begun. The primary objective of this follow-on test will be stack cost reduction. 40 figures, 33 tables.

11274 **(DOE/ET/17076—T1) Barriers and incentives to commercialization of fuel cell technology in cogeneration applications. Final report.** (Pennsylvania Univ., Philadelphia (USA). Energy Center). Dec 1981. Contract AC01-80ET17076. 180p. NTIS MF A01; 2; GPO Dep. File Number DE85006293.

The ultimate commercialization of a new energy technology rests heavily upon its economic viability. Recent studies of fuel cell technology commercialization have focused on the supply side and the role of government in reducing the risk exposure of the initial commercial manufacturers of fuel cells. Little attention has been paid, however, to the demand side and the role government incentives might have on the potential users of the technology. This study identifies a number of existing and potential barriers to and incentives for adopting fuel cells by these users. Industry and electric utility ownership are considered. A discounted cash-flow model is developed to test the sensitivity of financial performance to a variety of financial incentives and identified credits. These credits are attributable to fuel cell performance and environmental benefits compared to other technologies. Finally the report describes an initial analytical framework for exploring the relative effectiveness of alternative incentives. The focus of this study is on cogeneration applications for fuel cells because this use has shown promise in previous studies. The Cogeneration Systems Application of Fuel Cells Working Group (COSAF, 1980), a group of DOE contractors who evaluated the application of fuel cells to industrial cogeneration, identifed the Hooker Chemical (Occidental Petroleum) chlorine/caustic acid plant in Taft, Louisiana as a representative industrial site. Louisiana Power and Light which currently supplies power to the Hooker Plant was selected to study the utility owned cogeneration approach.

11275 **(DOE/FE/60338—16) Phosphoric acid electric utility fuel cell technology development. Technical progress report No. 16, August 1984.** Breault, R.D.; Briggs, T.A.; Congdon, J.V.; Gelting, R.L.; Goller, G.J.; Luoma, W.L.; McCloskey, M.W.; Mientek, A.P.; O'Brien, J.J.; Randall, S.A. (United Technologies Corp., South Windsor, CT (USA). Power Systems Div.). 1984. Contract AC21-83FE60338. 46p. (FCR—6673F). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85004716.

The Department of Energy has initiated this program to advance electric utility cell stack technology and to reduce cell stack cost. The cell stack has a nominal 10-ft² active area and operates at 120 psia/405°F. The program comprises six parallel phases, which culminate in a full-height, 10-ft² stack verification test. Progress is reported. Program highlights include: (1) over 550 hours and four thermal cycles with performance close to the E-line goal have been accumulated on the second 10-ft² 28-cell stack at 120 psia and 405°F; (2) over 12,400 hours and 35 thermal cycles have been accumulated on the 3.7-ft² 30-cell stack at 120 psia and 405°F; (3) a subscale cell cut from 10-ft² electrodes in the same batch used for the second 10-ft², 28-cell stack has accumulated over 2200 hours with performance close to E-line at 120 psia and 400°F; and (4) testing was completed on the first three builds of the 7-cell, crosspressure tolerance stack. (WHK)

11276 **(DOE/MC/15078—7-3) Molten carbonate fuel cell performance model update. Quarterly report, April-June 1984. Draft.** Wilemski, G.; Gelb, A.; Kemp, N.H. (Physical Sciences, Inc., Andover, MA (USA)). Aug 1984. Contract AC21-81FE15078. 17p. (PSI-TR—455). NTIS, PC A02/MF A01; GPO Dep. File Number DE85005423.

This report contains a description of recent improvements on the heterogeneous film model of porous electrodes, a model intended to be a reasonable depiction of ERC's ceramic coated Ni anodes and to serve as a first approximation to GE's and ANL's Ni/Cr anodes. The connectivity of the porous coated, metal network was treated by imagining the idealized cylindrical model elements to be packed into a simple cubic structure. Treating the connectivity adds a degree of realism to the model and, by properly accounting for volume excluded at cube corners, forces the lateral dimensions of the cylindrical elements to more nearly conform with dimensions apparent in SEM's of actual electrodes. Work on the computer codes needed to calculate vertical concentration gradients in the gas flow channels has also progressed. The cathode code is running and capable of rapidly producing fully converged numerical results. The anode code, more complicated because of the imposition of water-gas shift equilibrium at the channel walls, was partially debugged this quarter.

11277 **(FCR—6827P) Phosphoric and electric utility fuel cell technology development. Technical progress report No. 18, October 1984.** Breault, R.D.; Briggs, T.A.; Congdon, J.V.; Gelting, R.L.; Goller, G.J.; Luoma, W.L.; McCloskey, M.W.; Mientek, A.P.; O'Brien, J.J.; Randall, S.A. (United Technologies Corp., South Windsor, CT (USA). Power Systems Div.). 1984. Contract AC21-83FE60338. 48p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85006349.

The Department of Energy has initiated this program to advance electric utility cell stack technology and to reduce cell stack cost. The cell stack has a nominal 10-ft² active area and operates at 120 psia/405°F. The program comprises six parallel phases, which culminate in a full-height, 10-ft² stack verification test. Progress is reported. Over 1300 hours and nine thermal cycles with performance close to the E-line goal have been accumulated on the second 10-ft² short stack at 120 psia and 405°F. A subscale cell cut from 10-ft² electrodes in the same batch used for the second 10-ft² short stack has accumulated over 3500 hours with performance conform-

ing to the E-line goal at 120 psia and 400°F. Over 13,500 hours and 38 thermal cycles have been accumulated on the 3.7-ft², 30-cell short stack at 120 psia and 405°F. An advanced configuration subscale cell is operating at 47 mV above E-line after 1300 hours at 120 psia, 400°F and 400 ASF. The improved edge seal decreased leakage by more than 50% from the conventional edge seal. Cross-pressure tolerance also improved. Continuous automatic operation of the substrate forming machine was demonstrated by producing substrates at a 50% faster rate with high yields and low material loss. Significantly reduced the cooler bonding cycle by using a cold press (for cool down) in conjunction with the hot (bonding) press.

11278 **Molten carbonate fuel cell cathode materials study.** Baumgartner, C.E.; Arendt, R.H.; Iucovangelo, C.D.; Karas, B.R. (General Electric Company, Corporate Research and Development, Schenectady, New York). *Journal of the Electrochemical Society;* **131**: No. 10, 2217-2220(Oct 1984).

Data are presented on the electronic conductivity and molten alkali carbonate stability (Li:K binary of 62:38 mole ratio) of various materials at 923 K under a 30% CO_2/air atmosphere. Of the examined materials, only $LaNiO_3$ and La /SUB x/ Sr_1- /SUB x/ CoO_3 satisfied both criteria sufficiently for acceptable use as molten carbonate fuel cell cathode materials.

11279 **Electrochemistry of carbonaceous materials and coal.** Park, S.M. (Department of Chemistry, University of New Mexico, Albuquerque, New Mexico). *Journal of the Electrochemical Society;* **131**: No. 9, 363C-374C(Sep 1984).

Electrochemistry of carbonaceous material and coal is reviewed comprehensively. The subject is divided into five categories: electrochemistry of various forms of carbon, chemical oxidation and reduction of coal, electrochemical oxidation and reduction of coal, photoelectrochemistry of coal, and direct power generation from coal burning fuel cells. Oxidation of coal by air or oxygen and reduction through hydrogenation reactions are not included in this review. Only reports relevant to solution chemistry are included. Characterization and derivatization of coal and carbonaceous material employing the above electrochemical reactions are discussed in each section.

11280 **Electrochemistry of fuel cells for transportation applications.** Gonzalez, E.R.; Srinivasan, S. (Los Alamos National Laboratory, Los Alamos, NM). *International Journal of Hydrogen Energy;* **9**: No. 3, 215-218(1984).

Fuel cells are promising power sources for electric vehicles and do not suffer from the inherent limitations of efficiency, energy density, and lifetime, as encountered with all types of batteries considered for this application. The projected performance of fuel-cell vehicles is comparable to that of the internal combustion and diesel engine vehicles but with the additional advantages of higher fuel efficiency, particularly with synfuels from coal. The ideal fuel for a fuel-cell power plant for electric vehicles is methanol. This fuel is reformed to hydrogen, which combines with oxygen from the air in an acid electrolyte (phosphoric, solid polymer, or superacid) fuel cell to produce electricity. Though the phosphoric acid fuel cell is in the most advanced state of development (mainly for power generation applications), the solid polymer and superacid electrolyte fuel cells are more promising for the transportation application because of the faster oxygen reduction kinetics (and hence potential for higher power densities) and shorter start-up times. Alkaline electrolyte fuel cells can be used only with pure hydrogen which causes a weight or energy penalty for any of the methods it can be carried on board the vehicle), but have the best potential for minimizing or eliminating noble metal requirements. The paper summarizes needed areas of research (i.e. reduction or elimination of noble metal loading, finding CO-tolerant electrocatalysts, finding less expensive solid polymer electrolytes, synthesis and elucidation of higher molecular weight superacids) to advance fuel-cell technology for vehicular applications.

11281 **Electrocatalyst advances for hydrogen oxidation in phosphoric acid fuel cells.** Stonehart, P. (Stonehart Associates, Inc., P.O. Box 1220, Madison, CT). *International Journal of Hydrogen Energy;* **9**: No. 11, 921-928(1984).

The important considerations that presently exist for achieving commercial acceptance of fuel cells are centered on cost (which translates to efficiency) and lifetime. This paper addresses the questions of electrocatalyst utlization within porous electrode structures and the preparation of low-cost noble metal electrocatalyst combinations with extreme dispersions of the metal. Now that electrocatalyst particles can be prepared with dimensions of 10 A, either singly or in alloy combinations, a very large percentage of the noble metal atoms in a crystallite are available for reaction. The cost savings for such electrocatalysts in the present commercially driven environment are considerable.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

3201 Buildings

REFER ALSO TO CITATION(S) 32010011231, 11232, 11304, 11311, 11313, 11313, 11316

11282 (BNL—51748, pp 3-19) **Introduction and background.** Jhirad, D.J. (Brookhaven National Lab., Upton, NY). 1983. NTIS, PC A14/MF A01. File Number DE84017244. (CONF-830365—).

From Seminar on energy efficiency and conservation; Lome, Togo, Africa (30 Mar 1983).

The West African region, consisting of the 16 member countries of the Economic Community of West African States (ECOWAS) faces severe energy and economic problems. In common with many other developing countries, the oil-importing ECOWAS nations have been seriously affected by the rise in oil prices of the 1970s, while simultaneously confronting the problem of dwindling supplies and increasing costs of traditional fuels such as fuelwood and charcoal. Recognizing that cooperative energy strategies at the regional level can play an important role in complementing country-level initiatives, ECOWAS convened its first energy symposium in Freetown, Sierra Leone, in November 1981, with financial support from the US Agency for International Development. The fourteen project recommendations made at the symposium were later endorsed by the ECOWAS Council of Ministers at Cotonou, Benin, in May 1982. Following this meeting, planning was undertaken for implementation of the first of its recommendations: convening a working seminar on energy efficiency and conservation in the power generation, transportation, industrial, and building subsectors. The seminar was held in Lome, Togo, March 30 - April 8, 1983. A synopsis of the sessions is presented.

11283 (BNL—51748, pp 23-35) **Overview of the energy situation in ECOWAS countries.** Shaikh, A.M. (Energy/Development International, Washington, DC). 1983. NTIS, PC A14/MF A01. File Number DE84017244. (CONF-830365—).

From Seminar on energy efficiency and conservation; Lome, Togo, Africa (30 Mar 1983).

The main features of commonality and diversity within ECOWAS countries are discussed. A series of statistics and perspectives, which, when taken together, may create a picture of value is presented. The implications of the topic are that the energy situation in any country is the product of that country's economic situation, and at the same time, is a component of that economic situation. The relationship between energy and economics is the principal reason for being concerned with energy. At the macroeconomic level, energy is an essential input into production and exchange. Energy scarcity can constrain or disrupt those processes and high energy costs can siphon resources from other high priority development objectives. At the level of individual decision-making units, energy can be viewed primarily as the cost of doing economic activity. The importance attached to energy by private decision-makers will depend on the ratio of energy costs to total costs, the existence of alternatives to high priced energy inputs, and the ability to pass costs along to consumers.

11284 (BNL—51748, pp 261-273) **Potential of building electricity systems for load reduction and load levelling.** Leigh, R.W. (Brookhaven National Lab., Upton, NY). 1983. NTIS, PC A14/MF A01. File Number DE84017244. (CONF-830365—).

From Seminar on energy efficiency and conservation; Lome, Togo, Africa (30 Mar 1983).

A sample list of energy conservation options are examined and many economically advantageous steps that can be taken to reduce electricity costs (if an adequate rate structure is in effect) are demonstrated. In many cases, the analysis can be done in an extremely simple manner. Although computers and advanced mathematical techniques are valuable in energy planning on a national or utility level, most of the calculations needed to analyze energy conservation devices and techniques can be done by hand on a single sheet of paper (with the help of a calculator). Some of the more useful techniques are demonstrated. Understanding these techniques is more important than remembering the particular examples, since any conservation idea must be analyzed for the particular application in question, using local weather data, the correct building characteristics, and electric rates for the utility in question.

11285 (BNL—51748, pp 241-260) **Technological and economic issues in building energy use.** Curtis, R.B.; Weingart, J.M. (Aerolithos Inc., San Mateo, CA). 1983. NTIS, PC A14/MF A01. File Number DE84017244. (CONF-830365—).

From Seminar on energy efficiency and conservation; Lome, Togo, Africa (30 Mar 1983).

Demographic projections indicate a rapid growth in the cities of West Africa over the coming several decades. The buildings constructed during this period will be operated well into the next century and the amount of energy they use will be an important dimension of the economics of the region. There is an opportunity for the nations of the region to insure that buildings are designed and operated in an efficient manner, freeing valuable capital and electricity supply and distribution infrastructure for other uses. Commercial buildings are one of the largest single users of electricity in West Africa. Some 40% of the electrical energy produced in the ECOWAS countries is reportedly used for air conditioning, lighting, and water heating. The need for appropriate architectural design and new building materials that could reduce electricity consumption is discussed.

11286 (DOE/OR/21400—T82) **Latent heat storage in cooling systems.** Tomlinson, J.J. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005355.

In building space conditioning applications where cooling is a major component, thermal energy storage can be used to shift the electrical cooling load imposed on a utility during peak cooling loads and small buildings located in summer peaking utility service areas are particularly attractive for application of this technology. Ice is the latent heat storage material most commonly used as the thermal storage medium for building cooling; however, new materials including clathrates, salt hydrates, and liquid-liquid systems are being explored. This paper discusses cool storage applications and provides an overview of research underway to develop these new latent heat materials.

11287 (DOE/R4/10164—T1) **Eckerd College Energy Systems Project. Final technical report.** DeGroot, D.E. (Eckerd Coll., St. Petersburg, FL (USA)). 6 Feb 1984. Contract FG44-80R410164. 14p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005449.

The Eckerd College Energy Systems Project (ESP) consisted of four interrelated components: Organic gardening; Aquaculture (Tilapia); Methane gas conversion and utilization as energy source to drive an electric generator; Solar water heating component. These components were designed to demonstrate the feasibility of using alternative technologies to reduce petro-chemical energy dependency, to provide faculty and staff with hands-on A.T. experience, and to involve the general community in A.T. energy experiences. The Organic, Aquaculture and Solar components were successful. The Methane project was not. The educational goals of the project were met or exceeded. It is strongly recommended that DOE/AT support ESP like programs at all educational levels as part of our national commitment to developing an increasing capability for energy self sufficiency in the general population.

11288 (DOE/R4/10452—T1) **Improving the thermal conductivity and storage capacity of European type ceramic tile stoves using olivine, July 15, 1982-June 31, 1984.** (Propst (Ronald), Winston-Salem, NC (USA)). 1984. Contract FG44-81R410452. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005445.

The processing, properties, and performance of olivine-based brick and special cast shapes used to build wood burning thermal storage stoves are reported. (MHR)

11289 (LBL—16220) **Fundamental problems with visual performance research described in the CIE 19/2 report.** Clear, R.; Berman, S. (Lawrence Berkeley Lab., CA (USA)). May 1983. Contract AC03-76SF00098. 23p. (CONF-8308163—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004655.

From Annual Illuminating Engineering Society conference; Los Angeles, CA, USA (8 Aug 1983).

The CIE 19/2 model of performance cannot be used to predict performance or productivity. Counter-examples to the link assumed in CIE 19/2 between performance and productivity are presented. Statistical arguments show that the fitting parameters are not physically determined as was thought and that the curve fitting in the CIE 19/2 report does not constitute a validation. Some critics of CIE 19/2 have suggested that RQQ No. 6 be used in its place for lighting calculations. RQQ No. 6 is simply a consensus of present practice. The more robust visibility trends presented in CIE 19/2 are inconsistent with the recommendations in RQQ No. 6. Careful use of the material in CIE 19/2 could lead to better recommendations than are exemplified by RQQ No. 6.

11290 (LBL—18046) **DOE-2 Building Energy Analysis Program.** Curtis, R.B.; Birdsall, B.; Buhl, W.F.; Erdem, E.; Eto, J.; Hirsch, J.J.; Olson, K.H.; Winkelmann, F.C. (Lawrence Berkeley Lab., CA (USA)). Apr 1984. Contract AC03-76SF00098. 27p. (CONF-8405264—1). NTIS, PC A03/MF A01; GPO Dep. File Number DE85005108.

From ASEAN conference on energy conservation in buildings; Singapore, Singapore (1 May 1984).

The DOE-2 Building Energy Analysis Program was designed to allow engineers and architects to perform design studies of whole-building energy use under actual weather conditions. Its development was guided by several objectives: (1) that the description of the building entered by the user be readily understood by non-computer scientists, (2) that, when available, the calculations be based upon well established algorithms, (3) that it permit the simulation of commonly available heating, ventilating, and air-conditioning (HVAC) equipment, (4) that the computer costs of the program be minimal, and (5) that the predicted energy use of a building be acceptably close to measured values. These objectives have been met. An overview of the program upon completion of the DOE-2.1C edition is given.

11291 (LBL—18248) **Daylighting data for atrium design.** Navvab, M.; Selkowitz, S. (Lawrence Berkeley Lab., CA (USA)). Aug 1984. Contract AC03-76SF00098. 10p. (CONF-840954—11). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005164.

From 9. national passive solar conference; Columbus, OH, USA (23 Sep 1984).

This paper focuses on atrium characteristics that influence the admittance and distribution of solar gain and daylight. We report on results of an extensive series of scale-model tests in a large sky simulator. Total visible transmittance of complex atrium glazing systems were measured using a large, newly developed integrating sphere. Performance results are describved in terms of several generic geometric factors (cross section, length, width, height), orientation, interior surface treatments, and glazing systems for different sun and sky conditions. We describe how measured illuminance data in atria can be used to determine if an atrium design will

admit adequate light for plant growth or provide adequate light for typical office tasks in spaces adjacent to the atrium.

11292 **(ORNL/CON—166) Three years after participation: electricity savings due to the BPA Residential Weatherization Pilot Program.** Hirst, E.; White, D.; Goeltz, R. (Oak Ridge National Lab., TN (USA)). Jan 1985. Contract AC05-84OR21400. 51p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85004773.

The Bonneville Power Administration operated a Residential Weatherization Pilot Program from 1980 through 1982. The program provided free home energy audits to 7200 electrically heated homes in the Pacific Northwest and gave zero-interest loans to weatherize 4100 of these homes. The total cost of the program was almost $11 million. This report estimates the net energy-saving effect of the BPA program (i.e., the electricity saving that can be directly attributed to the program) as well as the total energy saving. The data used in this analysis include one year of preprogram and three years of postprogram electricity consumption records. The first stage of our method involves estimation of weather adjusted annual electricity consumption for each household. The second stage uses this weather adjusted consumption as the dependent variable in a pooled time-series/cross-section regression model of electricity use.

11293 **(ORNL/CON—168) Energy savings one and two years after participation in Minnesota home energy audit and retrofit loan programs.** Hirst, E.; Goeltz, R. (Oak Ridge National Lab., TN (USA)). Jan 1985. Contract AC05-84OR21400. 45p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85004770.

Northern States Power (NSP), the largest utility in Minnesota, operates several residential energy conservation programs. This report updates a 1983 detailed quantitative evaluation of two of these programs. The Minnesota Energy Conservation Service (MECS), Minnesota's version of the federal Residential Conservation Service, provides home energy audits and related services to households who live in structures with four or fewer dwelling units and pay gas or electricity bills to a utility participating in MECS. Between April 1981 and December 1982, NSP conducted almost 12 thousand audits. The data collected for this evaluation are described briefly. The factors that affect household energy use and how these factors might be included in models are discussed, from which estimates of program energy savings are derived. These sections focus primarily on differences between the present work and the earlier analysis of the NSP programs. The results of this analysis on total and net natural gas savings are presented.

11294 **(PB—85-110849/XAB) Comparison of manufactured-housing thermal characteristics.** (National Conference of States on Building Codes and Standards, Inc., Herndon, VA (USA)). 10 Sep 1984. 47p. NTIS, PC A03/MF A01.

The thermal design characteristics of mobile/manufactured housing plans which were approved by Design Approval Primary Inspection Agencies are evaluated. The primary objective of this study is to determine if currently available technology being used in the manufactured housing industry can result in manufactured homes being built to meet the existing Farmers Home Administration (FmHA) thermal standards for residential construction. A total of 65 housing designs were reviewed. Of these designs, 45% meet the FmHA thermal criteria for all 5 climatic zones, 25% are within 10% of meeting the thermal criteria for all 5 climatic zones, and 30% do not meet the thermal criteria for all 5 climatic zones. This report concludes that extensive redesign is not needed to produce manufactured housing meeting the FmHA thermal standards.

11295 **168 proof?.** Misuriello, H.P.; Deringer, J.J.; Moreno, S. *Progressive Architecture;* No. 4, 134-139(1983).

Over the last year, this series of energy-conscious design articles has taken a fresh look at the largest building research project ever undertaken: the energy redesign of 168 building designs in 13 building types as part of DOE's Building Energy Performance Standards (BEPS). Although many design professionals are aware of the controversial regulatory aspects of BEPS, an analysis of the actual redesign strategies forming the technical basis of the design energy budgets has never appeared in print prior to this series.

11296 **Energy to recover.** Misuriello, H.; Deringer, J.J.; Moreno, S. *Progressive Architecture;* No. 2, 136-139(1983).

The energy redesign of hospitals is the subject of this article in this energy-conscious design series. Although the demanding environmental requirements of hospitals limit the use of conservation strategies that are viable in other building types, the researchers found that HVAC and heat recovery strategies were keys in dramatically reducing energy use without compromising health care criteria.

11297 **Dwelling with energy.** Misuriello, H.P.; Deringer, J.J. *Progressive Architecture;* No. 10, 108-111(1982).

This article concentrates on energy strategies for multifamily dwellings. Solar control and design features play a surprisingly influential role in energy use, while enhancing both private and public space. These design features are discussed.

11298 **Energy design of office buildings.** Misuriello, H.; Deringer, J.J. *Progressive Architecture;* No. 6, 109-113(1982).

The energy-conscious design series features the office building research portion of the redesign experiment described in the April issue of P/A. It focuses on the key energy design strategies, used by the redesign teams, which contributed to the substantial annual energy reductions accomplished through the office building redesigns.

11299 **Energy for sales.** Deringer, J.J.; Misuriello, H.P. *Progressive Architecture;* No. 8, 86-89(1982).

The energy series article this month focuses on retail buildings. After reorganizing the original data, the research team discovered both general strategies of great promise and design options of importance only to certain types of retail stores. These design options are discussed.

3202 Transportation

REFER ALSO TO CITATION(S) 32020011213, 11282, 11283

11300 (BNL—51748, pp 277-295) **Transportation/energy analysis: principles and practice.** Carroll, T.O. (State Univ. of New York, Stony Brook). 1983. NTIS, PC A14/MF A01. File Number DE84017244. (CONF-830365—).

From Seminar on energy efficiency and conservation; Lome, Togo, Africa (30 Mar 1983).

Almost without exception, energy earmarked for transportation equals or exceeds energy consumed by any other sector of the economy of developing countries. Moreover, transportation equipment almost invariably utilizes higher priced fuels, such as lighter distillates--gasoline or diesel. Thus, both the high level of demand from the transportation sector and the types of fuel demanded aggravate the balance of payments problem for the oil-importing developing country. The energy requirements for transportation increase rapidly with economic development. In fact, demand for both passenger and freight transportation tends to increase in greater proportion to that of the overall economic growth. Attempts by many developing countries to control this expansion of energy use in transportation are discussed.

11301 (BNL—51748, pp 296-299) **Potential for energy conservation in Dakar transportation system.** Garrigues, C. (SEMA Energie, Montrouge, France). 1983. NTIS, PC A14/MF A01. File Number DE84017244. (CONF-830365—).

From Seminar on energy efficiency and conservation; Lome, Togo, Africa (30 Mar 1983).

Urban transport systems used in Dakar are reviewed. Their characteristics are given. It was found that: private cars are very energy intensive, require a lot of space and, consequently, a lot of investment. 33,000 cars consume 41% of the fuel used in the Dakar area, require 86% of the space available, and provide only 33% of the transit needs; in contrast, the 264 SOTRAC buses consume 20% of the fuel, require only 2% of the space, but provide 37% of the transit needs. Their efficiency in terms of km x trip/consumption is 3.3 times higher than cars; and shifting 1% of the transit

demand from cars to SOTRAC buses means a yearly savings of $ 0.6 million/year. This indicates that the government should promote SOTRAC buses and discourage the use of private cars.

11302 **Impact of electric cars on national energy consumption.** Agarwal, P.D. (Gen. Mot. Corp. Res. Lab.). *SAE Automot. Eng. Congr. Pap.;* No. 800111, 1-5(1980). (CONF-800202—).

From SAE automotive engineering congress and exposition; Detroit, MI, USA (25 Feb 1980).

Analytical and experimental studies carried out by General Motors Corp., as well as by the University of California Lawrence Livermore Laboratory under contract to the U.S. Department of Energy, have shown that in times of gasoline shortage, an electric vehicle, even with limited range, could provide convenient transportation for most automobile trips, although it would not save primary energy resources. U.S. dependence on foreign oil could be reduced much quicker and at much lower cost by converting electric-utility boilers from oil to coal. With regard to vehicle fuel efficiency, and with petroleum as the prime energy source, an electric vehicle with nickel-zinc batteries would consume 50% more prime energy than a vehicle with an internal-combustion (IC) engine, and an electric vehicle with lead-acid batteries would consume 150% more. With coal as the prime energy source, the energy consumption of the electric vehicle with nickel-zinc batteries would be about equal to that of the IC engine vehicle, but with lead-acid batteries, its prime energy consumption would be ~ 65% greater.

3203 Industry And Agriculture

REFER ALSO TO CITATION(S) 32030010863, 11014, 11217, 11250, 11251, 11252, 11253, 11282, 11283, 11669

11303 (BNL—51748, pp 36-72) **Importance of energy efficiency in the developing countries.** Jhirad, D.J. (Brookhaven National Lab., Upton, NY). 1983. NTIS, PC A14/MF A01. File Number DE84017244. (CONF-830365—).

From Seminar on energy efficiency and conservation; Lome, Togo, Africa (30 Mar 1983).

Some results from ongoing work at the Brookhaven National Laboratory on the economics and potential for energy-efficiency and substitution in the developing countries are presented. The emphasis is on energy conservation in the industrial sector. A detailed financial analysis of one particular technology, industrial heat pumps, is presented for one developing country, Brazil, to illustrate the effect of government financial incentives on the attractiveness of investments in energy efficiency. Studies in the industrialized countries have revealed that, from an economic and technological viewpoint, there are substantial opportunities for using energy more efficiently in all sectors of the national economy. One representative study has indicated that an average of 25% of energy use in the US manufacturing sector could be saved through measures whose capital and life-style costs are less than those needed to generate equivalent amounts of new energy supply. A straightforward yet powerful technological idea appears therefore to be an essential ingredient in all short- and long-term energy options: that the aggressive development and implementation of energy efficiency technologies is an essential element of any financially and economically responsible energy plan.

11304 (BNL—51748, pp 75-194) **Industrial energy management.** Tunnah, B.G. (E/DI Europe Ltd., London, England). 1983. NTIS, PC A14/MF A01. File Number DE84017244. (CONF-830365—).

From Seminar on energy efficiency and conservation; Lome, Togo, Africa (30 Mar 1983).

In many developing countries, industry represents the most important consumer of imported petroleum products and of electricity. Industry may also consume significant quantities of non-commercial fuels, such as wood and charcoal. The potential benefits of improving the efficiency of use of energy by industry can therefore be very important in developing countries. The rational use of energy will often provide an opportunity to reduce energy imports, to save scarce foreign currency, and thus to accelerate the development process overall. It is, therefore, important that developing countries be encouraged to examine industrial energy consumption at the plant level, to identify actions needed, and to establish priorities for the training of manpower and the investment of capital. The emphasis should be on immediate action to improve energy efficiency in the factories, including basic training for local engineers in the principles and practice of energy conservation. Energy management programs that will result in reductions in the level of energy consumption in particular processes or factories are discussed. Energy management seeks to make each unit of energy input produce more in terms of the output of useful work, thereby freeing incremental energy supplies for purposes related to economic expansion and development.

11305 (BNL—51748, pp 195-202) **Industrial energy conservation in Morocco and Senegal.** Garrigues, C. (SEMA Energie, Montrouge, France). 1983. NTIS, PC A14/MF A01. File Number DE84017244. (CONF-830365—).

From Seminar on energy efficiency and conservation; Lome, Togo, Africa (30 Mar 1983).

Energy conservation activities in Morocco and Senegal are discussed. In Morocco, 13% of the energy consumed by the industrial sector could be saved by a $80 million investment. Its payback period would be 1.7 years and the annual savings would be $50 million. In Senegal, 10% of the oil consumption could be saved with a payback period of less than 3 years. This amount could be increased to 40% by considering energy conservation measures connected with extension and modernization investments. The potential for energy conservation in Moroccan and Senegalese industry is discussed.

11306 (BNL—51748, pp 205-209) **Preventive maintenance in the electric power sector.** Shoun, P.H. (Tennessee Valley Authority, Chattanooga). 1983. NTIS, PC A14/MF A01. File Number DE84017244. (CONF-830365—).

From Seminar on energy efficiency and conservation; Lome, Togo, Africa (30 Mar 1983).

The role of preventive maintenance in the electric power industry is discussed. A good preventive maintenance program is the key to a safe and reliable operating utility. A good maintenance program will also contribute significantly to energy efficiency and conservation. Such a program must fit into the whole concept of building and operating a power system. In order to be successful, a preventive maintenance program should have at least five major ingredients: good planning and design, good construction and installation, good inspection and test, good operational checks and scheduled maintenance, and good documentation and recordkeeping.

11307 (BNL—51748, pp 221-238) **Energy efficiency in electrical power generation and industrial sectors.** Sharan, H.N. (Sharan Engineering Ltd., Winterthur, Switzerland). 1983. NTIS, PC A14/MF A01. File Number DE84017244. (CONF-830365—).

From Seminar on energy efficiency and conservation; Lome, Togo, Africa (30 Mar 1983).

One of the major goals of national economic policy, both for developing as well as industrialized countries, is the rational utilization of primary energy resources. Globally dwindling fossil fuel reserves, especially oil and gas, increasing energy prices, and widespread lack of national fossil fuel resources demand solutions which enable maximum efficiencies to be obtained at economically viable costs and minimal ecological impact. For industrialized countries, higher efficiencies of utilization and conservation are imperative in order to offset the adverse effects of rising energy costs on their standards of living. Conservation of energy has to be done in many ways and at diverse levels of technology, investments, and policies. The broader perspectives of efficient energy utilization are highlighted, covering power station technology including co-generation of power and process energy and giving examples of fuel savings in combustion systems.

11308 **(DOE/CE/15101—T1) [Continuous casting process-prototype]. Final report.** (Techmet Corp., Greenwich, CT (USA)). 1984. Contract FG01-82CE15101. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84015357.

A two phase program was undertaken in order to evaluate the use of a sliding gate valve vs conventional refractories for the Controlled Rate Solidification Process. Considerable problems were

encountered with the operation at the slide gate valve and product quality was extremely poor compared to previous castings utilizing conventional refractories. An improved version of the conventional refractory system was installed to replace the slide gate mechanism and an immediate improvement in both operating reliability and product quality was observed. It is now believed that a redesign of the conventional refractory system, incorporating knowledge gained during this program will allow for the production of defect free billets.

11309 **(PB—84-221829) Reducing/separating recoverable demolition wastes with cavitating water jets. Technical report on phase 1.** Conn, A.F.; Frederick, G.S. (Hydronautics, Inc., Laurel, MD (USA)). Mar 1982. 79p. (TR—8226/1). NTIS, PC A05/MF A01.

Results are presented of a project to determine the feasibility of using cavitating water jets to reduce the size of building debris, thus facilitating separation of materials for recycling. Slot cutting experiments were conducted on blocks of concrete containing steel reinforcing bars, which were taken from recently demolished buildings. Slot configurations were determined as a function of the pressure, water flow, and rate of translation for various nozzles. The results suggest that a 208 kW cavitating jet system should be capable of separating steel re-bar and concrete debris at an effective average rate of at least 41 tons per hour, at a cost of about $1.42 per ton.

11310 **(PB—85-118529/XAB) Sliding-Bed (trademark) aluminum-scrap preheater. Final report, October 1982-May 1984.** Hersch, C.A.; Nelson, R.N. (Midland-Ross Corp., Toledo, OH (USA). Energy Technology Div.). May 1984. 80p. (R—1288). NTIS, PC A05/MF A01.

A continuous Sliding Bed preheater has been developed for preheating secondary aluminum scrap prior to melting in an aluminum melter. A packed bed of scrap is formed and allowed to slide down a stationary hearth composed of overlapping plates. Hot process gases are blown through gaps between the plates to heat the scrap bed. The preheater uses melter exhaust gases as the sole heat source. Preheating scrap prior to melting can increase a melter's production capacity and reduce fuel consumption on a Btu/Lb basis.

11311 **Conservation's value varies with view.** Hirst, E. (Oak Ridge National Lab., TN). *Electrical World;* 69-70(Jul 1984).

A great deal of money is spent on utility conservation programs. Little has been done, however, to measure program performance in a consistent manner using actual program-generated data. The major issues that need to be addressed are discussed and an evaluation of a residential retrofit program in the Pacific Northwest is used to discuss their implications.

11312 **(OA-tr—1859) Application of the heat pump for concentration by evaporation and for drying in agricultural foodstuffs industries.** Legendre, E.; Bonduelle, F. (Overseas Relations Branch Translation Service, London (UK)). Sep 1982. Translation source information not available . (CONF-7704133—5-Trans.). 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85900530.

From Comite Francais d'Electrothermie symposium; Verailles, France (21 Apr 1977).

An evaporator specially designed for combining with mechanical compression of damp vapours is described, with an account of a typical installation used for distillery effluents. An account is also given of the elaboration of a fluidised-bed dryer for vegetable products in conjunction with a heat pump, with reference to the studies and tests in progress.

11313 **(OA-tr—2430) Possibilities of heat recovery in induction heating and melting.** Krabiel, H.; Pautz, J. (Overseas Relations Branch Translation Service, London (UK); Elektowaerme-Inst. e.V., Essen (Germany, F.R.)). May 1982. Translation source information not available . (CONF-7810298—1-Trans.). 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85900547.

From AIM conference on induction heating and melting; Liege, Belgium (2 Oct 1978).

An analysis of energy consumption in induction heating and melting equipment is given, and the possibilities of utilising the waste heat are discussed. An experimental heat recovery installation is described where heat from the cooling water is used to heat the finishing shops, office buildings and domestic water. Depreciation times are plotted, related to oil prices, on the basis of the investment and operating costs of the installation.

3206 Municipalities And Community Systems

REFER ALSO TO CITATION(S) 32060011011, 11012

11314 **(NP—5900441) Effectiveness of regional committees in implementing regional resource recovery programs.** Mellea, B.C. (Massachusetts Inst. of Tech., Cambridge (USA). Lab. of Architecture and Planning). Feb 1978. 198p. Laboratory of Architecture and Planning, MIT, Cambridge, MA 02139. File Number TI85900441.

Thesis.

One promising approach to implementing resource recovery programs is through regional, ad-hoc committees comprised of and responsive to citizens and local officials. Regional, locally-based committees appears to be the most fruitful path to effective solid waste management. Using telephone interviews, case studies of seven committees, scattered throughout the country, were prepared. Committees were analyzed by comparing and contrasting their reactions to the problems of proposing and managing resource recovery programs. Intended for people seeking to start a regional committee, this thesis offers recommendations on how, at critical points in the committee's work, decisions should be made. Committee formation, its structure, techniques for facility siting, and approaching to evaluating alternative technologies are considered. Strategies for providing information to the public and winning local acceptance of regional resource recovery programs are discussed. Hopefully, this work will facilitate public involvement in solid waste management and speed the implementation of appropriate recovery programs.

11315 **DOE's Collins predicts need for 680 plants by 2000.** Minner, D. *Electric Light and Power;* **62**: No. 11, 11(Nov 1984).

First Pittsburgh coal conference.

A high-ranking DOE official predicts that the US will need to build the equivalent of 680 new or replacement power plants of 600 MW capacity by the year 2000, or an average of 13 additional plants for every state. His prediction assumes a three percent growth rate in power consumption and gross national product. Coal-fired generation will account for 60% of generating capacity by 1995. The Reagan Administration expects the private sector to fund research on new generating technologies. A spokesman for Energy Ventures Analysis, Inc., noting that coal technology needs a major breakthrough, was less optimistic about the accuracy of forecasts for either demand or prices.

3209 Education And Public Relations

11316 **(LBL—17920) Windows, skylights, and atria: occupants' visual/subjective comparison.** Ne'eman, E.; Selkowitz, S. (Lawrence Berkeley Lab., CA (USA)). May 1984. Contract AC03-76SF00098. 13p. (CONF-8406232—1; EEB-W—84-09). NTIS, PC A02/MF A01; GPO Dep. File Number DE85004589.

From ASHRAE international symposium on the interface between the building envelope and HVAC systems; Kansas City, MO, USA (17 Jun 1984).

Windows, skylights, and glazed atria are all used for admission of daylight into buildings. This paper concentrates on a comparison of subjective occupant attitudes and response to these design strategies. First, the problem is defined. Then the light directional properties of the various solutions are examined and a comparison made between possible subjective/psychological responses to these solutions. The aspects of the view outside the building, spectral distribution, the variability of daylight, and the effect of the depth of daylight penetration into the built spaces and the re-

sultant light intensities are examined and the subjective responses are compared.

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

3301 Internal Combustion Engines

REFER ALSO TO CITATION(S) 33010011067, 11321, 11321

3302 External Combustion Engines

11317 **(DOE/NASA/51040—59) Effect of water on hydrogen permeability.** Hulligan, D.D.; Tomazic, W.A. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center; Sverdrup Technology, Middleburg Heights, OH (USA)). 1984. Contract AI01-77CS51040. 12p. (NASA-TM—86904; CONF-8410103—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE85004683.

From Automotive technology development contractors' coordination meeting; Dearborn, MI, USA (29 Oct 1984).

Doping of hydrogen with CO or CO_2 was developed to reduce hydrogen permeation in Stirling engines by forming low permeability oxide coatings in the heater tubes. An end product of this process is water - which can condense in the cold parts of the engine system. If the water vapor is reduced to a low enough level, the hydrogen can reduce the oxide coating resulting in increased permeability. This work was done to define the equilibrium level of water (oxygen-bearing gas) required to avoid reduction of the oxide coating. Results at 720°C and 13.8 MPa have shown that, (a) pure hydrogen will reduce the coating, (b) 500 ppM CO (500 ppM water equivalent) does not prevent the reduction, and (c) 500 ppM CO_2 (1000 ppM water) appears to be close to the equilibrium level.

3303 Electric-powered Systems

REFER ALSO TO CITATION(S) 33030011258, 11280, 11302

11318 **(ANL/OEPM—83-5) Development of aqueous batteries for electric vehicles. Summary report, October 1981-December 1983.** Cook, G.M.; Miller, J.F. (comps.). (Argonne National Lab., IL (USA)). Apr 1984. Contract W-31-109-ENG-38. 56p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85004940.

This report summarizes the results and status of activities in the Aqueous Mobile Battery Research Program of the Argonne National Laboratory (ANL) for the period from October 1981 through December 1983. This program is conducting R and D on lead-acid, nickel/iron and has conducted R and D on nickel/zinc batteries for electric vehicles. Performance verification testing of contractor supplied cells, modules, and batteries is performed by the ANL National Battery Test Laboratory (NBTL). Various supporting activities are conducted by ANL. Key results of the R and D are reported, that indicate major technology advancements since the project inception in FY 1978. During the past two years, substantial improvements have been made in the testing capability of the NBTL in the areas of hardware, software and special instrumentation. The number of test stations was increased so that, under the proper conditions, it is possible to simultaneously and independently test up to 76 units. Extensive performance and life verification tests have been performed by NBTL on improved lead-acid and nickel/iron modules delivered by the industrial contractors. The ANL effort also includes special battery performance testing and engineering modeling. The special battery testing includes determination of the temperature dependence of the cycle life of ISOA lead-acid batteries, measurements of overcharge requirements and self-discharge rates, and studies of the effects of pulsed discharging. Generic thermal models were developed. ANL aids technology transfer by testing and evaluating eV batteries under alternative conditions for other interested parties. ANL also monitors the results of eV test and evaluation programs being performed by site operators.

3307 Emission Control

11319 **(PB—84-223056) Low mileage catalyst evaluation with a methanol-fueled Rabbit - second interim report. Technical report.** Wagner, R.D.; Landman, L.C. (Environmental Protection Agency, Ann Arbor, MI (USA)). Jun 1984. 188p. NTIS, PC A09/MF A01.

See also PB83-241620.

This report summarizes a test program which was designed to evaluate various exhaust catalysts at low mileage on a pure methanol-fueled Volkswagon Rabbit automobile. Hydrocarbons, carbon monoxide, nitrogen oxides and formaldehyde emissions were measured to identify which catalysts are the best candidates for durability testing in a later program. Catalysts formulations that are eventually selected for durability testing should cost no more, and preferably less, than the original catalyst on the vehicle. In addition, all catalysts should provide the capability to meet the Federal Exhaust Emission Standards for hydrocarbon (HC), carbon monoxide (CO) and nitrogen oxide (NOx).

3308 Alternative Fuels

REFER ALSO TO CITATION(S) 33080011015

11320 **(AD-A—143530/4) Engine wear with methanol fuel in a nitrogen-free environment. Interim report May-December 1983.** Naegeli, D.W.; Yost, D.M.; Owens, E.C. Jr. (Southwest Research Inst., San Antonio, TX (USA). Army Fuels and Lubricants Research Lab.). May 1984. 37p. (AFLRL—175). NTIS, PC A03/MF A01.

Several test programs have shown that the combustion of methanol in spark ignition engines can cause unusually high corrosive wear of the upper cylinder bore and ring areas. In this study, a 2.3-liter engine fueled with methanol was operated in a nitrogen-free atmosphere to determine the importance of nitric acid in the corrosion mechanism. A 20-hour steady-state test was carried out using neat methanol as the fuel and a mixture of oxygen, argon, and carbon dioxide in place of air. The intake and exhaust gases were frequently analyzed to be sure their compositions were constant and free of nitrogen. Emission measurements showed only trace amounts (1 ppm) of NOx in the exhaust. Analysis of the condensates from the exhaust and blow also showed that the wear indicated by iron buildup in the lubricant was essentially the same in the nitrogen-free test as that detected in baseline engine tests combusting methanol-air mixtures. It was concluded that nitric acid does not play a role in the corrosion of the upper cylinder bore and ring areas of methanol-fuelded engines.

11321 **(NIPER—23-Vol.3) Utilization research, Volume III. Monthly progress report for November 1984.** (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)). 14 Dec 1984. Contract FC01-83FE60149. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85004852.

Analytical instrumentation for determination of methyl nitrite in the exhaust of neat methanol fueled vehicles was installed for Project OU1A. Candidate fuels containing heavy aromatic stocks were formulated and are being evaluated. Results from an 8-mode test sequence were used to simulate emissions and fuel consumption results for 13-mode and transient EPA test cycles in Project OU1B. The results of the simulation will be compared with the engine manufacturer's results to determine the appropriateness and applicability of the simulation. Particulate samples of a composite of several engine operating modes were collected in Project OU2. After extraction, analysis of this sample will be compared with individual mode samples to test the representativeness of the compositing test methodology.

36 MATERIALS

11322 (DOE/ER—0212) Materials Sciences Division long range plan. (USDOE Office of Energy Research, Washington, DC. Office of Basic Energy Sciences). Dec 1984. 45p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85005642.

The intent of this document is to provide a framework for programmatic guidance into the future for Materials Sciences. The Materials Sciences program is the basic research program for materials in the Department of Energy. It includes a wide variety of activities associated with the sciences related to materials. It also includes the support for developing, constructing, and operating major facilities which are used extensively but not exclusively by the materials sciences.

11323 (UCID—18574-84-2) H-Division materials physics quarterly report, April-June 1984. Moriarty, J.A. (ed.). (Lawrence Livermore National Lab., CA (USA)). 7 Dec 1984. Contract W-7405-ENG-48. 66p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85004990.

The following topics are reported: railgun development; ultrahigh-pressure underground nuclear driven equation-of-state experiment; equation-of-state of Nevada tuff; possibility of Pr III having a thcp structure; possible missing structure in the rare-earth series; promotion energies and cohesion: a simple, accurate scheme for solids; a general correlation of thermal conductivity with equation of state; interdiffusion in a dense, binary ionic mixture; oscillator strengths calculated from effective potentials; compliant material response characterization; numerical coupling of an unstable boundary layer flow and a compliant surface; and three-particle heat flow in one dimension via the Boltzmann equation.

3601 Metals And Alloys

REFER ALSO TO CITATION(S) 3601010876, 11007, 11041, 11055, 11096, 11114, 11310, 11481, 11492, 11761, 11912, 11988

11324 (AD-A—143469/5) Electron localization and superconductivity of very thin epitaxially grown Ag films on Ge(001). Technical report. Lince, J.R.; Williams, R.S.; Chaikin, P.M. (California Univ., Los Angeles (USA)). Jul 1984. 12p. (TR—3). NTIS, PC A02/MF A01.

Transport properties of very thin (2.5 monolayer) films of Ag epitaxially grown on clean Ge(001) substrates are reported. The films consists of a monolayer coverage plus isolated three-dimensional islands. Below approx. 70 K, the conductivity is dominated by the metal film and displays the temperature and electric and magnetic field dependences characteristic of metallic weak localization in two dimensions. Below approx. 2 K, the resistance drops rapidly in a manner resembling an incomplete superconducting transition. The resistance is restored by application of a magnetic field of approx. 20 K Gauss 0.6 K.

11325 (BNL—35432) Local electrochemistry of pitting corrosion in stainless steels. Isaacs, H.S.; Newman, R.C. (Brookhaven National Lab., Upton, NY (USA); University of Manchester Inst. of Science and Technology (UK). Corrosion and Protection Centre). 1984. Contract AC02-76CH00016. 23p. (CONF-8410207—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85005207.

From Conference on corrosion chemistry within pits, crevices and cracks; Teddington, UK (1 Oct 1984).

The following features of localised corrosion in stainless steels are described and illustrated: diffusion-controlled dissolution and salt films; active dissolution kinetics and the effects of alloying additions such as Mo; coupling of active dissolution and diffusion; the pitting potential; repassivation and the protection potential. In addition, the coupling of a pit anode and a passive surface is described with reference to neutral oxygenated chloride solutions. In the initiation stage of pitting the pit draws current mostly from the capacitance of the passive film, not from the oxygen reduction reaction. Some implications of these aspects are discussed.

11326 (BNL—35568) Applications of the vibration probe to localized current measurements. Isaacs, H.S.; Ishikawa, Yuichi. (Brookhaven National Lab., Upton, NY (USA); Hitachi Ltd., Tsuchiura (Japan). Mechanical Engineering Research Lab.). 1985. Contract AC02-76CH00016. 10p. (CONF-850311—6). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004702.

From National Association of Corrosion Engineers annual meeting and materials performance and corrosion show; Boston, MA, USA (25 Mar 1985).

The principles, advantages, and applications of a scanning vibrating electrode technique are presented. The technique has been used to locate the position of localized corrosion and heterogeneities on surfaces and to determine their polarization characteristics. The technique has been applied to the study of aluminum pitting, crevice corrosion of stainless steel and organic and metallic coatings on steels.

11327 (BNL-NUREG—35520) Mechanisms of stress corrosion cracking and intergranular attack in Alloy 600 in high temperature caustic and pure water. Bandy, R.; van Rooyen, D. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 10p. (CONF-8410208—1). NTIS, PC A02/MF A01 - GPO. File Number TI85005129.

From ASM international conference on corrosion of nickel base alloys; Cincinnati, OH, USA (23 Oct 1984).

In recent years, several studies have been conducted on the intergranular stress corrosion cracking (SCC) and intergranular attack (IGA) of Alloy 600. A combination of SCC and IGA has been observed in Alloy 600 tubing on the hot leg of some operating steam generators in pressurized water reactor (PWR) nuclear power plants, and sodium hydroxide along with several other chemical species have been implicated in the tube degradations. SCC has been observed above and within the tube sheet, whereas IGA is generally localized within the tube sheet. Alloy 600 is also susceptible to SCC in pure and primary water. Various factors that influence SCC and IGA include metallurgical conditions of the alloy, concentrations of alkaline species, impurity content of the environment, temperature and stress. The mechanisms of these intergranular failures, however, are not well understood. Some of the possible mechanisms of the SCC and IGA in high temperature water and caustic are described in this paper.

11328 (CONF-841157—43) First principles theory of Fermi-surface driven concentration waves in Cu/sub c/Pd/sub 1-c/ alloys. Stocks, G.M.; Wadsworth, J.; Gyorffy, B.L. (Oak Ridge National Lab., TN (USA); Bristol Univ. (UK). H.H. Wills Physics Lab.). 1984. Contract AC05-84OR21400. 3p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005367.

From Symposium on the scientific basis for nuclear waste management; Boston, MA, USA (26 Nov 1984).

The first-principles methods are based on the use of the Korringa-Kohn-Rostoker coherent-potential approximation (KKR-CPA). A mean-field theory of ordering in alloys has been developed that is based on the KKR-CPA method for treating the underlying electronic structure. Contour maps are presented for the short-range order diffuse scattering from Cu/sub c/Pd/sub 1-c/ alloys. The expression for $\alpha(K)$ is dominated by a contribution from the Fermi energy. The concentration waves are Fermi-surface driven. (DLC)

11329 (CONF-841157—51) Time resolved x-ray studies during pulsed laser irradiation of Ge. Tischler, J.Z.; Larson, B.C.; Mills, D.M. (Oak Ridge National Lab., TN (USA); Cornell Univ., Ithaca, NY (USA)). 1984. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005263.

From Symposium on the scientific basis for nuclear waste management; Boston, MA, USA (26 Nov 1984).

Synchrotron x-ray pulses from the Cornell High Energy Synchrotron Source (CHESS) have been used to carry out nanosecond resolution measurements of the temperature distributions in Ge during uv pulsed-laser irradiation. KrF (249 nm) laser pulses of 25 ns FWHM with an energy density of 0.6 J/cm^2 were used. The temperatures were determined from x-ray Bragg profile measure-

ments of thermal expansion induced strain on <111> oriented Ge. The data indicate the presence of a liquid-solid interface near the melting point, and large (1500 to 4500 C/μm) temperature gradients in the solid; these Ge results are analogous to previous ones for Si. The measured temperature distributions are compared with those obtained from heat flow calculations, and the overheating and undercooling of the interface relative to the equilibrium melting point are discussed. 6 references, 3 figures.

11330 **(CONF-841157—58) Magnetic studies of Ni_3Al(Fe) compounds.** Sekula, S.T.; Kerchner, H.R.; Thompson, J.R.; Leventouri, T. (Oak Ridge National Lab., TN (USA)). Nov 1984. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005262.

From Symposium on the scientific basis for nuclear waste management; Boston, MA, USA (26 Nov 1984).

Several samples of the ordered intermetallic compound with the $L1_2$ structure and chemical composition Ni/sub 0.75-x/Al/sub 0.25-x/Fe/sub 2x/ (doped with 0.2 at. % B) have been studied over an Fe compositional range $0 \leqq 2x \leqq 0.20$. Stoichiometric Ni_3Al is known to be a strongly exchange-enhanced material, forming a gaint moment system when Fe impurities are introduced in trace amounts. For the greater Fe concentrations employed in this work, more conventional ferromagnetic systems are obtained. Well below the ferromagnetic Curie temperature T/sub c/ the samples exhibit a spontaneous moment in small magnetic fields and at higher fields the isothermal magnetization data show a clear tendency toward saturation. Magnetic investigations using vibrating-sample techniques permitted measurements over the temperature interval from 4.2 K to 800 K in fields up to 5.0 T. The Curie temperature was found to increase from about 50 K for the Fe-free sample in the series to 410 K for the limiting concentration of 12 at. % Fe in the $L1_2$ structure. Samples with higher Fe content up to 20 at. % contain a second, disordered fcc phase with T/sub c/ = or about 715 K. Peaks in the temperature dependence of the lattice parameter observed in x-ray studies yield T/sub c/ values in reasonable agreement with the magnetic measurements. 17 references, 4 figures.

11331 **(CONF-841157—60) Small-angle x-ray scattering (SAXS) study of coarsening kinetics in an aluminum-lithium alloy.** Spooner, S. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005241.

From Symposium on the scientific basis for nuclear waste management; Boston, MA, USA (26 Nov 1984).

Coarsening kinetics was studied in a $Al_{90.6}Li_{9.4}$ alloy aged at 100°C, 128°C, 178°C, and 209°C. The time-dependent behavior of the average precipitate radius followed t/sup 1/3/ behavior. The precipitate/matrix interfacial energy obtained from analysis of the kinetic constant was 0.015 J/M^2 and was largely independent of temperature. The scattering curves exhibit interparticle interference which prevents us from calculating a particle size distribution. 12 references, 3 figures, 3 tables.

11332 **(CONF-8404219—1) Creep crack growth in ductile alloys.** Argon, A.S.; Lau, C.W.; Ozmat, B.; Parks, D.M. (Massachusetts Inst. of Tech., Cambridge (USA)). 1984. Contract AC02-77ER04461. 20p. NTIS, PC A02. File Number DE85003937.

From IUTAM/ICF/ICM Eshelby memorial symposium; Sheffield, UK (2 Apr 1984).

Creep crack growth in ductile alloys involves considerable fragmentation of the crack tip region in its early phases of growth. This is a result of the defocusing action of crack tip blunting by both distortional and cavitational strains on the distribution of intergranular creep damage and is affected significantly by the initial sharpness of the crack. Specific models of intergranular damage combining non-steady creep flow, evolution and growth of grain boundary facet cracks in the inelastic deformation field leading to final fracture have been developed. When used in conjunction with finite element programs for crack tips, these damage models can explain such crack extension modes. The combination of mechanistic three dimensional damage models and large strain finite element codes, promise to be of wide-spread utility in predicting the development of creep damage under complex loading histories.

11333 **(CONF-8409179—5) Tracer diffusion in an ordered alloy: application of the path probability and Monte Carlo methods.** Sato, Hiroshi; Akbar, S.A.; Murch, G.E. (Purdue Univ., Lafayette, IN (USA). School of Materials Engineering; Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 63p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85002768.

From American Institute of Mining, Metallurgical and Petroleum Engineers conference; Detroit, MI, USA (17 Sep 1984).

Tracer diffusion technique has been extensively utilized to investigate diffusion phenomena and has contributed a great deal to the understanding of the phenomena. However, except for self diffusion and impurity diffusion, the meaning of tracer diffusion is not yet satisfactorily understood. Here we try to extend the understanding to concentrated alloys. Our major interest here is directed towards understanding the physical factors which control diffusion through the comparison of results obtained by the Path Probability Method (PPM) and those by the Monte Carlo simulation method (MCSM). Both the PPM and the MCSM are basically in the same category of statistical mechanical approaches applicable to random processes. The advantage of the Path Probability method in dealing with phenomena which occur in crystalline systems has been well established. However, the approximations which are inevitably introduced to make the analytical treatment tractable, although their meaning may be well-established in equilibrium statistical mechanics, sometimes introduce unwarranted consequences the origin of which is often hard to trace. On the other hand, the MCSM which can be carried out in a parallel fashion to the PPM provides, with care, numerically exact results. Thus a side-by-side comparison can give insight into the effect of approximations in the PPM. It was found that in the pair approximation of the CVM, the distribution in the completely random state is regarded as homogeneous (without fluctuations), and hence, the fluctuation in distribution is not well represented in the PPM. These examples thus show clearly how the comparison of analytical results with carefully carried out calculations by the MCSM guides the progress of theoretical treatments and gives insights into the mechanism of diffusion.

11334 **(DOE/ER/45098—5) Research consortium for x-ray topography on line X-19 at NSLS. Technical progress report, June 1-December 1, 1984.** Bilello, J.C. (State Univ. of New York, Stony Brook (USA). Dept. of Materials Science and Engineering). 1 Dec 1984. Contract FG02-84ER45098. 13p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85004882.

SXRF studies have been made on Zn-0.6 at. % Cd crystals fractured at 77°K. It is concluded that this dilute alloying primarily modifies the dislocation relaxation accompanying fracture. The effective surface energy of Zn-Cd is plotted as a function of composition, and it can be seen that the observed fracture toughness is primarily due to plastic relaxation in the crack initiation phase and secondarily due to crack propagation. (DLC)

11335 **(DOE/OR/21400—T85) New series of advanced 3Cr-Mo-Ni steels for thick section pressure vessels in high temperature and pressure hydrogen service. Topical report, February 1, 1982-January 31, 1984.** Ritchie, R.O.; Parker, E.R.; Spencer, P.N.; Todd, J.A. (California Univ., Berkeley (USA). Dept. of Materials Science and Mineral Engineering). Sep 1984. Contract AC05-84OR21400. 53p. (UCB/RP—84/D1020). NTIS, PC A04/MF A01; GPO Dep. File Number DE85005327.

A new series of 3Cr-Mo-Ni steels has been developed for use in thick section pressure vessels, specifically for coal conversion (high temperature and high pressure hydrogen) service. The new steels rely on minor alloy modifications to commercial 2-1/4Cr-1Mo (ASTM A387 Grade 22 Class 2) steel. Based on evaluations in relatively small heats (55 kg), the experimental alloys, which employ additions of Cr, Ni, Mo and V, with Mn at 0.5 wt% and C at 0.15 wt%, display improved properties compared to commercial steels. Specifically, they show significantly improved hardenability (i.e., fully bainitic microstructures following normalizing of 400 mm (16 inch) plates), enhanced strength (i.e., yield strengths exceeding 600 MPa), far superior hydrogen attack resistance and better Charpy V-notch impact toughness, with comparable tensile ductility, creep rupture resistance and temper embrittlement resistance.

The microstructural features contributing to these improved mechanical properties are briefly discussed. 39 references, 22 figures, 5 tables.

11336 (HEDL—7492) Influence of titanium on the neutron-induced swelling of austenitic alloys. Garner, F.A.; Brager, H.R. (Hanford Engineering Development Lab., Richland, WA (USA)). Sep 1984. Contract AC06-76FF02170. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005719.

Addition of titanium to variants of AISI 316 stainless steel does not significantly alter the eventual swelling behavior of this class of steel during neutron irradiation. In general, titanium additions only temporarily suppress the onset of swelling.

11337 (HEDL—7509) Effects of irradiation on the fracture toughness of HT-9. Huang, F.H. (Hanford Engineering Development Lab., Richland, WA (USA)). 1984. Contract AC06-76FF02170. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005720.

Compact tension specimens of HT-9 irradiated at 390, 450 and 500°C were tested at 90, 205 and 450°C. Test results showed that both test and irradiation temperatures have insignificant effects on the fracture toughness of HT-9. However, the tearing modulus increases irradiation temperature. In addition, the toughness of HT-9 at 205°C where a toughness trough was observed for unirradiated HT-9 remained unchanged after irradiation to a fluence of 5.5 x 10^{22} n/cm^2.

11338 (HEDL—7517) Charpy impact test results of ferritic alloys at fluence to 6 x 10^{22} n/cm . Hu, W.L. (Hanford Engineering Development Lab., Richland, WA (USA)). 1983. Contract AC06-76FF02170. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005718.

One hundred and ten specimens made of HT-9 base metal, 9Cr-1Mo base metal and 9Cr-1Mo weldment at various heat treatment conditions were tested at -73 to 260°C. The specimens were irradiated from 390 to 550°C and the fluence of the specimens reached 6 x 10^{22}n/cm^2. Results show a small additional shift in transition temperature for HT-9 base metal irradiated at 390 and 450°C as the fluence was raised to 6 x 10^{22}n/cm^2. At higher irradiation temperatures, however, the shift in transition temperature is less conclusive. Further reduction in USE was observed at higher fluence for all the irradiation temperatures. There is no apparent fluence effect for 9Cr-1Mo base metal at all the irradiation temperatures studied. Contrary to the previous finding on HT-9 base metal and weldment, the 9Cr-1Mo weldment shows a higher transition temperature (+60°C) and a higher USE (+100%) as compared to the 9Cr-1Mo base metal for the same irradiation conditions. Significant improvement of both DBTT and USE on HT-9 base metal specimens fabricated from normalized and tempered plate stock was observed over the HT-9 base metal specimens fabricated from mill-annealed bar stock. Overall, the highest DBTT encountered for HT-9 alloys is 141°C for specimens irradiated at 390°C. The effect on transition temperature due to additional neutron exposure appears to be saturated at 6 x 10^{22}n/cm^2. The highest DBTT encountered for 9Cr-1Mo alloys, on the other hand, is 91°C for the weldment and 45°C for base metal both irradiated at 390°C. 7 figures, 7 tables.

11339 (IS-T—1064) Vibrational frequencies and structural properties of transition metals via total-energy calculations. Fu, C.L. (Ames Lab., IA (USA)). Sep 1983. Contract W-7405-ENG-82. 134p. NTIS, PC A07/MF A01; GPO Dep. File Number DE85005625.

Thesis.

We have used a self-consistent pseudopotential method within local-density-functional theory to calculate the equilibrium ground state properties of transition metals Mo, Nb, Zr. Equilibrium lattice constants, cohesive energies, and bulk moduli are in excellent agreement with experiment. First principles frozen phonon calculations are then performed for the longitudinal (2/3,2/3,2/3) phonon in Mo, Nb, and bcc Zr as well as the H-point phonon in Mo and Nb. The validity of the adiabatic approximation is investigated for the Mo H-point phonon. The microscopic interactions responsible for the vast frequency differences of the longitudinal (2/3,2/3,2/3) phonon in Mo, Nb, and Zr are analyzed making use of the Hellmann-Feynman theorem.

11340 (Juel—1903) Investigation of the isothermal precipitation behaviour of nickel-base alloys using electrochemical phase extraction. Kirchhoefer, H.; Rottmann, J.; Schubert, F.; Nickel, H. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorwerkstoffe und Heisse Zellen; Technische Hochschule Aachen (Germany, F.R.)). Mar 1984. 135p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85750265.

Electrochemical phase extraction methods have been developed empirically for the selective separation of the precipitates in metallic materials. A detailed description of the process has been undertaken to allow optimization for various nickel-base alloys. For this part of the investigation, 16 model alloys were prepared as test electrodes and the electrolyte composition was varied over a wide range. The results enabled a series of effects to be explained on the basis of electrochemical data. The large number of test parameters limited the scope of the preliminary experiments and the range of model alloys used. In the nickel-base alloys, titanium carbo-nitride and primary M_6C precipitates were identified. During isothermal ageing, $M_{23}C_6$ (except in Alloy KSN), Ni_3Al (in INCONEL 617), Laves phases (in Hastelloy X and INCONEL 617), $M_{12}C$ (in HASTELLOY X and INCONEL 617) and α-tungsten (in the tungsten-containing alloys) were precipitated. The precipitation behaviour changed in the alloys investigated from intracrystalline to intercrystalline with increasing ageing temperature. The intracrystalline secondary precipitations affect the microhardness, structure and the solid-solution lattice.

11341 (LA—10199-T) Phase stability and magnetic properties of UAl_2 based pseudobinary spin fluctuation compounds. Wire, M.S. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 108p. NTIS, PC A06/MF A01; GPO Dep. File Number DE85005317.

Thesis. Submitted to Univ. of California, San Diego, La Jolla.

The compound UAl_2 is thought to exhibit ferromagnetic spin fluctuations. The phase stability, magnetic susceptibility, specific heat, and electrical resistivity of UAl_2 with various atoms substituted for U have been studied. The U/sub 1-x/La/sub x/Al_2, U/sub 1-x/Lu/sub x/Al_2, and U/sub 1-x/Ce/sub x/Al_2 pseudobinary systems were found to have miscibility gaps. These gaps are not related to a size effect and thus must be related to the type of chemical bonding in these alloys. A simple model explaining the position of the miscibility gap edge is proposed. The magnetic susceptibility, chi, of alloys formed by substituting La or Y for U in UAl_2, was found to rise quite rapidly with the concentration of atomic substituent. Substitutions of Sc, Zr, Ce, and Lu were found to have a much smaller effect on chi. It is concluded that it is the chemical bonding rather than any size or statistical dilution effect that is responsible for these differences. It was found that the low temperature upturn in the specific heat, plotted as C/T vs T^2, caused by spin fluctuations was not suppressed by alloying in the U/sub 1-x/La/sub x/Al_2 system, while the Stoner enhancement factor and the electronic density of states were found to rise quickly with x in these alloys. The electrical resistivities of these pseudobinary alloys were studied. The residual resistivities of these alloys rose quite rapidly with atomic substitutions. The electrical resistance at high pressures and low temperature was studied for both UAl_2 and UPt_3 (UPt_3 is also a spin fluctuator). An analysis that allows an inference of the pressure dependence of the chi from the pressure dependence of the resistance is presented. 79 references, 44 figures, 2 tables.

11342 (LA-UR—84-3810) Plutonium metal and alloy preparation by molten chloride reduction. Reavis, J.G. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 18p. (CONF-841210—10). NTIS, PC A02/MF A01; GPO Dep. File Number DE85005726.

From International chemical congress of Pacific Basin Societies; Honolulu, HI, USA (16 Dec 1984).

Satisfactory reduction of molten plutonium trichloride (pure and in combination with 20 wt % sodium chloride) by calcium, lanthanum, and cerium has been demonstrated on the 10-g scale. The

yields were satisfactory for this scale of operation, and it is indicated that these reductions may be useful for large-scale operations. Significant separations of plutonium from rare earth impurities was demonstrated for lanthanum and cerium reductions. Preparation of plutonium-cerium and plutonium-cerium-cobalt alloys during reduction was also demonstrated.

11343 **(N—84-21705) Chemical vapour deposition coating of hard metals with special reference to boron and boron compounds.** Voigt, K.; Westphal, H. (UKAEA Risley Nuclear Power Development Establishment). Jan 1984. 16p. British Library Lending Div., Boston Spa, England.

The possible ways of depositing hard materials containing boron onto hard metal using chemical vapor deposition technology (CVD) are presented. The deposition of boron containing hard material layers and the strengthening of the substrate in the region of the layer are combined in a suitable process. CVD equipment with a cold wall retort has proved suitable for carrying out the coating process. The results of this research were used in the development of multi-range coated hard metal tips for machining short chip materials. Because of their outstanding physical properties and chemical resistance, high melting point inorganic boron compounds such as boron carbide, cubic boron nitride and heavy metal borides have found increasingly wide application, particularly in the last 30 years, in metallurgy, in industrial furnace construction, as grinding and polishing agents, and in reactor and materials technology.

11344 **(NAA-SR-TDR—12550) Tensile and stress rupture tests of S8DR Hastelloy-N heats: ORNL verification tests.** Lee, S.K. (Atomics International Div., Canoga Park, CA (USA)). 5 Oct 1967. 22p. NTIS, PC A02. File Number DE85004473.

In connection with the ORR Hastelloy-N irradiation experiments, a limited number of tensile tests and uniaxial and biaxial stress-rupture tests on S8DR Hastelloy-N heats were conducted at AI to determine the effect of some of the ORNL test conditions. The tests performed at AI were in parallel to the ORNL control tests. The results showed that the effect of the test condition variations between the two tests were generally insignificant. The effect of the test conditions is discussed.

11345 **(PNL-SA—12326) Test methods to predict long-term corrosion of container materials in repositories.** Merz, M.D.; Wang, R. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1984. Contract AC06-76RL01830. 9p. (CONF-841157—49). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004553.

From Symposium on the scientific basis for nuclear waste management; Boston, MA, USA (26 Nov 1984).

MCC test methods in support of basalt, salt and tuff repositories are described. The methods consist of three general corrosion tests for basalt, two general corrosion tests and three corrosion tests for salt, and two general corrosion tests for tuff. The tests encompass the various conditions that are expected in the different repositories. A summary is provided of experimental activities of the MCC, and detailed results of MCC 105.1 Test Method for Long Term General Corrosion in a Basalt Repository (Static System) for standardized, benchmark conditions are presented. A summary of the statistical treatment of data is provided with examples of confidence intervals and the dependence on number of test vessels. The total relative standard deviation for the mean corrosion penetration rate was 11.4% for a mean corrosion penetration rate of 0.0244 mm/y for 120 d tests at 100°C. 2 references, 3 figures, 4 tables.

11346 **(PNL-SA—12341) Role of segregated P and S in intergranular stress corrosion cracking of nickel.** Jones, R.H.; Danielson, M.J.; Baer, D.R. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1984. Contract AC06-76RL01830. 15p. (CONF-8410208—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85004547.

From ASM international conference on corrosion of nickel base alloys; Cincinnati, OH, USA (23 Oct 1984).

Effect of P and S on the intergranular corrosion and stress corrosion of Ni has been evaluated with corrosion tests, crack tip corrosion modeling and stress corrosion tests and modeling. Corrosion tests were conducted on Ni + P and Ni + S alloys and Ni samples ion implanted with P and S. Results showed that both P and S reduce passivity in Ni and enhance the corrosion rate but that P is oxidized and dissolves in the electrolyte while S remains on the surface. This difference in surface behavior of P and S was used to explain the difference in IGC and IGSCC behavior of Ni + P and Ni + S. The active crevice and crack walls with Ni + S is thought to reduce the concentration gradient and hence the transport of Ni^{+2} from tip to mouth which in turn reduces crack tip corrosion rate. By comparison of the geometry, potential dependence and rates of IGC and IGSCC of Ni + P it was concluded that IGSCC was not controlled solely by anodic dissolution but that a mechanical contribution was involved. Strain assisted corrosion was ruled out while a corrosion assisted intergranular fracture process was shown to be feasible.

11347 **(RFP—3655) Plutonium purification by vacuum distillation.** Moser, W.S.; Navratil, J.D. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 1984. Contract AC04-76DP03533. 25p. (CONF-8406230—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004696.

From American Chemical Society Rocky Mountain regional meeting; Albuquerque, NM, USA (6 Jun 1984).

Objective of this work was to address the theoretical requirements for volatile removal of Zn, Ca, and Mg, to compare the theoretical requirements and performance to results of initial testing, and to use the comparison as a guide to further work. The development and process evaluation has suggested a number of areas where performance may be improved still further, e.g. cooler condenser, minimization of refluxing, improved transfer area for Zn transport, and improved mixing. (DLC)

11348 **(RFP—3715) Mechanical properties of electrodeposited nickel and copper.** Krankota, J.L. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 9 Nov 1984. Contract AC04-76DP03533. 36p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85005321.

The strength and ductility of electrodeposited nickel and copper are similar to that of wrought and annealed sheet product. Percent elongation values for the thin (less than 50 mils, 1.25 mm) deposited sheet specimens strongly depend on the gage length. Reduction in thickness (related directly to reduction in area) is a better, more consistent indication of ductility at fracture. The effects of thickness and current density on strength and ductility are similar to those reported in References 1 and 2. However, little data are available for comparison of the biaxial properties. More data are needed on biaxial properties of Rocky Flats electrodeposits to delineate correlations with thickness and current density. Heat treatment of copper electrodeposits reduces the scatter in data, in addition to producing the expected increase in ductility and decrease in strength. The effect of heat treatment on nickel and copper deposit properties will be determined in future studies. The strength and ductility of electrodeposited nickel and copper are sufficient for Rocky Flats applications. In the range of plating parameters used to deposit nickel and copper at Rocky Flats, no unusual phenomena are observed. 2 references, 27 figures, 2 tables.

11349 **(SAND—84-1230C) Thermodynamic and kinetic studies of pulsed laser annealing from transient conductivity measurements.** Peercy, P.S.; Thompson, M.O. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 25p. (CONF-841157—23). NTIS, PC A02/MF A01; GPO Dep. File Number DE85003677.

From Symposium on the scientific basis for nuclear waste management; Boston, MA, USA (26 Nov 1984).

Simultaneous measurements of the transient conductance and time-dependent surface reflectance of the melt and solidification dynamics produced by pulsed laser irradiation of Si are reviewed. These measurements demonstrate that the melting temperature of amorphous Si is reduced 200 +- 50°K from that of crystalline Si and that explosive crystallization in amorphous Si is mediated by a thin ($\leqq$ 20 nm) molten layer that propagates at ~ 15 m/sec. Studies with 3.5 nsec pulses permit an estimate of the dependence of the solidification velocity on undercooling. Measurements of the effect of As impurities on the solidification velocity demonstrate that high As concentrations decrease the melting temperature of Si (~

150°K for 7 at. %), which can result in surface nucleation to produce buried melts. Finally, the silicon-germanium alloy system is shown to be an ideal model system for the study of superheating and undercooling. The $Si_{50}Ge_{50}$ alloy closely models amorphous Si, and measurements of layered Si-Ge alloy structures indicate superheating up to 120°K without nucleation of internal melts. The change in melt velocity with superheating yields a velocity versus superheating of 17 +- 3 k/m/sec. 35 references.

11350 **(SAND—84-1292C) Reaction of amorphous NiNb films with crystalline metal overlayers.** Dobisz, E.A.; Doyle, B.L.; Perepezko, J.H.; Wiley, J.D.; Peercy, P.S. (Wisconsin Univ., Madison (USA); Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract FG02-84ER45096;AC04-76DP00789. 6p. (CONF-841157—53). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005483.

From Symposium on the scientific basis for nuclear waste management; Boston, MA, USA (26 Nov 1984).

In many cases the stability of amorphous films is influenced by interaction with metallic crystalline overlayers. Such interactions between Au, Ni, Nb and Ta overlayers and a-(Ni-Nb) films are reported. During interdiffusion Au overlayers reacted with a-(Ni-Nb) to form two different adjacent crystalline layers. In order to study the influence of realxation of the amorphous film on overlayer reaction several a-(Ni-Nb) samples were pre-annealed prior to Au deposition. High depth resolution Rutherford Backscattering Spectrometry (RBS) demonstrate that preannealing lowers the diffusion coefficient of Au in a-(Ni-Nb) at 450°C from $7.5x10^{-22}$ m^2/s to $8.7x10^{-23}$ m^2/s. During interdiffusion Ta was discovered to be substantially more inert than Au. For example, negligible interdiffusion between Ta and a-(Ni-Nb) at 505°C after 25 hours implies a diffusivity of less than $5x10^{-24}$ m^2/s. These observations allow assessment of some of the requirements for increasing the stability of crystalline-amorphous metal film layered structures. 14 references, 4 figures.

11351 **(SAND—84-8937) Isotope studies of Fe-18Cr-3Mo (100) oxidation using Raman spectroscopy.** Hamilton, J.C.; Anderson, R.J. (Sandia National Labs., Livermore, CA (USA)). Jan 1985. Contract AC04-76DR00789. 27p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85006321.

Raman spectra have been obtained for chromia and iron-chromium spinels grown on an Fe-18Cr-3Mo (100) surface by exposure to oxygen-16, oxygen-18, and a mixture of the two isotopes, at 700°C and 1.3 x 10^{-4} Pa total pressure. Raman spectroscopy has been combined with ion bombardment to profile the isotopically tagged compounds produced during sequential oxidation in the two isotopes. We conclude that growth of spinel and chromia on this surface occurs predominantly by cation diffusion. Mixing of isotopes by diffusion within the oxide scale during these oxidations was minimal. Mixing of isotopes during ion sputtering was not an impediment to the Raman analysis. 14 references, 5 figures, 1 table.

11352 **(Y/DV—397) Beta-to-alpha phase transformation in a uranium alloy.** Vandermeer, R.A. (Oak Ridge Y-12 Plant, TN (USA)). 28 Oct 1984. Contract AC05-84OS21400. 39p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85006179.

The behavior of the β to α phase transformation in uranium containing 359 ppM Si and 233 ppM Fe during continuous cooling and isothermal heat treatment was studied using dilatometry and metallography. The results support the view that the transformation was a massive transformation. For cooling rates between 0.01 K/s and 125 K/s the transformation temperature was a linear function of the square root of the cooling rate. The experiments agreed with a theoretical model in which the transformation start was controlled by classical nucleation events without a strain energy barrier. The temperature at which the Gibbs free energies of the α and β phases are equal was 881K (608°C). The average interface migration rate during transformation at 50K undercooling was 1.04 x 10^{-4} m/s. The transformation activation energy was approximately 3/4 that for volume diffusion in uranium. The transformation enthalpy was 2655 J/mole. The theoretical nucleation model was extended to include transformation under isothermal conditions. Using the extended model and parameters extracted from the continuous cooling studies, a time-temperature-transformation (TTT) diagram was calculated which compared favorably with one determined experimentally provided the temperature was below 881K (608°C). Prior thermal treatments that altered the parent β phase had an influence on the β to α transformation kinetics. Discrepancies between theory and experiment were rationalized in terms of solute effects and aberrations of the β phase microstructure. 14 references, 16 figures, 1 table.

11353 **Crystal structure of low cristobalite at 10, 293, and 473 K: Variation of framework geometry with temperature.** Pluth, J.J.; Smith, J.V.; Faber J. Jr. (Department of the Geophysical Sciences, The University of Chicago, Chicago, Illinois 60637). *Journal of Applied Physics;* **57**: No. 4, 1045-1049(15 Feb 1985).

The crystal structure of low cristobalite (SiO_2) was refined at 10, 293, and 473 K from time-of-flight neutron powder diffraction data. One of the Si-O distances and one Si-O-Si angle change considerably: 10 K, 1.602(1) and 1.617(1) A, 144.7(1)°, 473 K, 1.605(2) and 1.590(2) A, 148.4(1)°. The angular distortion of the SiO_4 tetrahedron is greater at 473 K than at the lower temperatures. Root-mean-square displacements of Si and O are greater for cristobalite than for quartz and coesite at room temperature. The negative correlation between Si-O distance and Si-O-Si angle for cristobalite is similar to that for quartz held at a higher temperature (~350 K). Any adjustment of the Si-O distance for riding motion between Si and O atoms would reduce the variation of Si-O distance with temperature and with Si-O-Si angle. Furthermore, adjustment of the Si-O-Si angle for rocking of the oxygen atom out of the Si-O-Si plane could improve the correlation between secant (Si-O-Si) and the isotropic chemical shift for ^{29}Si nuclear magnetic resonance in silica polymorphs. The temperature variation of the crystal structure of low cristobalite cannot be modeled by simple tilting of rigid tetrahedra.

11354 **Paramagnetic scattering from a cubic ferromagnet Pd_3MnSn.** Shirane, G.; Uemura, Y.J.; Wicksted, J.P.; Endoh, Y.; Ishikawa, Y. (Physics Department, Brookhaven National Laboratory, Upton, New York 11973). *Physical Review [Section] B: Condensed Matter;* **31**: No. 3, 1227-1232(1 Feb 1985).

Paramagnetic neutron scattering from the localized, metallic ferromagnet Pd_3MnSn is characterized for the entire range of energy and momentum (ω,Q) space for a temperature range between T/sub c/ (193 K) and room temperature. The scattering function $S(Q,\omega)$ can be well described by a simple double Lorentzian form $S(Q,\omega)$proportional$T[1/(\kappa_1^2+q^2)\ ]\Lambda_1 q^2/[(\Lambda_1 q^2)^2+\omega^2]$ where, for larger q, the q^2 dependence in both Lorentzian factors changes over to a more general functional form. These results are in marked contrast to the case of the cubic, insulating ferromagnet EuO. This study reinforces our current interpretation of the constant-energy ridges which have also been observed in Ni.

11355 **Superconductivity in uranium compounds with Cu_3Au structure.** Ott, H.R.; Hulliger, F.; Rudigier, H.; Fisk, Z. (Laboratorium fuer Festkoerperphysik, Eidgenoessische Technische Hochschule, Hoenggerberg, 8093 Zuerich, Switzerland). *Physical Review [Section] B: Condensed Matter;* **31**: No. 3, 1329-1333(1 Feb 1985).

Superconductivity has been observed in uranium compounds with partly disordered Cu_3Au-type crystal structure and interatomic U—U distances of more than 4 A. Low-temperature specific-heat experiments reveal no anomalous enhancement of the electronic specific heat thus distinguishing the present materials from the unconventional superconductors UBe_{13} and UPt_3.

11356 **Nuclear-magnetic-resonance study of electronic structure in the copper-niobium superlattice.** Yudkowsky, M.; Halperin, W.P.; Schuller, I.K. (Department of Physics and Materials Research Center, Northwestern University, Evanston, Illinois 60201). *Physical Review [Section] B: Condensed Matter;* **31**: No. 3, 1637-1639(1 Feb 1985).

Cu nuclear-magnetic-resonance studies of a Cu/Nb superlattice reveal that the Cu in the superlattice is divided into at least two electronically distinct regions. One region has a small anisotropic Knight shift and a spin-lattice relaxation rate approximately

30% larger than ordinary Cu. The other region has large dipolar isotropic and anisotropic frequency shifts; its spin-lattice relaxation rate is up to two orders of magnitude smaller than that of ordinary Cu.

11357 **Effect of pressure on spin fluctuations and superconductivity in heavy-fermion UPt_3.** Willis, J.O.; Thompson, J.D.; Fisk, Z.; de Visser, A.; Franse, J.J.M.; Menovsky, A. (Materials Science and Technology Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review [Section] B: Condensed Matter;* **31**: No. 3, 1654-1657(1 Feb 1985).

We have determined the effect of hydrostatic pressure on the susceptibility, on the T^2 temperature dependence of the spin-fluctuation resistivity, and on superconductivity in UPt_3. The spin-fluctuation temperature T/sub s/, derived from the slope of resistivity versus T^2, is used within a Fermi-liquid picture to calculate the susceptibility chi at T = 0 K. The depression of this calculated chi with pressure agrees with the directly measured value partial lnchi/partialP = -24 $Mbar^{-1}$. Both the superconducting transition temperature T/sub c/ and the initial slope of the upper critical field also decrease under pressure. We find that partial lnT/sub c//partialP = -25 $Mbar^{-1}$ and speculate upon correlations between chi and T/sub c/.

11358 **Initial stages of oxide formation on rhodium field emitters.** Kellogg, G.L. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Physical Review Letters;* **54**: No. 1, 82-85(7 Jan 1985). Contract AC04-76DP00789.

The nucleation and growth stage of oxide formation on Rh field emitters has been investigated by imaging atom-probe mass spectroscopy. Quantitative atom-probe analysis of samples heated in 1-Torr O_2 indicated that stoichiometric Rh_2O_3 is formed at temperatures as low as 500 K and suboxides are formed at lower temperatures. The activation energy for the process was determined from the temperature dependence of the surface oxygen accumulation rate to be 4—5 kcal/mole.

11359 **Kondo-lattice—mixed-valence resistance scaling in heavy-fermion $CeCu_6$ under pressure.** Thompson, J.D.; Fisk, Z. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review [Section] B: Condensed Matter;* **31**: No. 1, 389-391(1 Jan 1985).

From measurements of the electrical resistance of heavy-fermion $CeCu_6$ subjected to hydrostatic pressures, we infer a continuous pressure-induced transition from Kondo-lattice to more strongly mixed-valence behavior. The resistance is found to scale over an appreciable temperature interval with a pressure-dependent characteristic temperature that reflects this transition. Similarities in the resistive behaviors of $CeCu_6$ and $CeAl_3$ are discussed.

11360 **Observation of a first-order phase transition in Xe/Ta(110) by photoelectron spectroscopy.** Raaen, S.; Ruckman, M.; Strongin, M. (Brookhaven National Laboratory, Upton, New York 11973). *Physical Review [Section] B: Condensed Matter;* **31**: No. 1, 623-626(1 Jan 1985).

A photoemission study of submonolayer coverages of Xe on the Ta (110) surface, at temperatures around 20 and 80 K, is presented. We argue that at low coverages, less than roughly-equal15%, the Xe atoms occupy the "deep" sites on the surface, presumably in a disordered fashion. When the coverage is increased, the Xe atoms start forming islands at elevated positions above the Ta surface as the interaction between Xe forms a denser phase. Different local work functions in the two phases make it possible to study this first-order phase transition by photoelectron spectroscopy.

11361 **Magnetization density of 5f electrons in ferromagnetic PuSb.** Lander, G.H.; Delapalme, A.; Brown, P.J.; Spirlet, J.C.; Rebizant, J.; Vogt, O. (Institut Laue-Langevin, F-38042 Grenoble, France and Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review Letters;* **53**: No. 23, 2262-2265(3 Dec 1984).

The magnetization density of 5f electrons in PuSb has been measured by use of a single crystal and polarized neutrons. The spatial extent of the spin and orbital densities is such that the form factor has a maximum at $\sin\theta/\lambda \cong 0.2$ A^{-1}. The ground-state wave function is deduced. Evidence for anisotropic interactions is presented.

11362 **Tailored surface modification by ion implantation and laser treatment.** Picraux, S.T.; Pope, L.E. (Sandia National Labs., Albuquerque, NM). *Science (Washington, D.C.);* **226**: No. 4675, 615-622(9 Nov 1984).

An important trend in materials science is the use of increasingly sophisticated methods to control composition and microstructure during processing. Near-surface modification by ion implantation and laser treatment is one of these new methods for tailoring material properties. Novel materials have been formed which are far from thermodynamic equilibrium and which exhibit unexpected and useful properties. The most extensively studied property changes include modified electrical properties of semiconductors and improved wear, hardness, and corrosion resistance of metals. The high degree of control available with energetic beams allows relations between microstructure and properties to be systematically investigated at the atomic level. This article illustrates how ion and laser beam modification is being applied to advance both the technology and the exploratory science of materials..

11363 **Ductile ordered intermetallic alloys.** Liu, C.T.; Stiegler, J.O. (Oak Ridge National Lab., TN). *Science (Washington, D.C.);* **226**: 636-642(9 Nov 1984). Contract AC05-84OR21400.

Many ordered intermetallic alloys have attractive high-temperature properties; however, low ductility and brittle fracture limit their use for structural applications. The embrittlement in these alloys is mainly caused by an insufficient number of slip systems (bulk brittleness) and poor grain-boundary cohesion. Recent studies have shown that the ductility and fabricability of ordered intermetallics can be substantially improved by alloying processes and control of microstructural features through rapid solidification and thermomechanical treatments. These results demonstrate that the brittleness problem associated with ordered intermetallics can be overcome by using physical metallurgical principles. Application of these principles will be illustrated by results on Ni_3Al and Ni_3V-Co_3V-Fe_3V. The potential for developing these alloys as a new class of high-temperature structural materials is discussed.

11364 **Ion implantation metallurgy.** Picraux, S.T. (Sandia National Laboratories, Albuquerque, New Mexico). *Physics Today;* **37**: No. 11, 38-44(Nov 1984). Contract AC04-76DP00789.

Beams of ions penetrate the surfaces of metals, forming new metastable alloys with made-to-order properties such as increased resistance to chemical and mechanical attack.

11365 **1.2 Mbar shock loaded 304 stainless steel: residual structure and properties.** Staudhammer, K.P.; Johnson, K.A.; Olinger, B. (Los Alamos National Lab., NM). pp 419-422 of Shock waves in condensed matter: 1983. Asay, J.R.; Graham, R.A.; Straub, G.K. (eds.). New York, NY, USA; Elsevier Science Publishers B.V. (1984).

A unique radial shock loading design which allows specimen recovery was used to shock load 304 stainless steel. This design yields a specimen with a gradient of shock levels, up to 1.2 Mbar, a pulse duration of 1 μsec, and a strain rate of $\sim 10^6$/sec. The shock response of the 304 stainless steel was characterized by microhardness, optical microscopy, and magnetically measured α′-martensite content. The residual microstructures along with the α′-martensite morphology was investigated by transmission electron microscopy. A higher volume percent α′-martensite was observed over that of the flyer plate technique. At 1.2 Mbar a maximum of 72% α′-martensite was observed. These results are compared to previously generated flyer plate shock responses of similar pulse durations at comparable pressures.

11366 Comparison of the microstructures of as-cast and laser surface melted Ti-8Al-4Y. Konitzer, D.G.; Muddle, B.C.; Fraser, H.L. (Univ. of Illinois, Urbana). *Metallurgical Transactions, [Section] A: Physical Metallurgy and Materials Science;* **14A**: 1979-1988(Oct 1983). Contract AC02-76ER01198.

A Ti-8 at. pct Al-4 at. pct Y alloy has been cast in small quantities and subjected to laser surface melting treatments in an effort to produce a uniform distribution of fine-scale dispersoids by internal oxidation. The microstructure of both as-cast and laser-modified material have been characterized using transmission electron microscopy, energy dispersive X-ray spectroscopy, and convergent beam electron diffraction, and the identity and distribution of second phase dispersoids established. An ability to refine significantly the dendritic structure of the as-cast alloy by laser surface treatment is demonstrated. The matrix phase of the modified alloy is martensitic α', in contrast to the α phase of the as-cast material. The interdendritic phase observed in both as-cast and laser-modified material and the fine-scale dispersed particles (50 to 70 nm) in the as-cast alloy are shown to be rich in Y, with a structure consistent with that of the oxide Y_2O_3. Dispersoids within the laser modified zone are typically 8 to 20 nm in diameter and show a tendency to form preferentially at interlath boundaries of the martensite. The origins of these structures and their potential effects on the mechanical properties of the alloy are discussed briefly.

11367 Evaluation of anisotropic effective stress-strain criteria for the biaxial yield and flow of 2024 aluminum tubes. Stout, M.G.; Hecker, S.S.; Bourcier, R. (Los Alamos National Lab., NM). *Journal of Engineering Materials and Technology;* **105**: 242-249(Oct 1983).

2024 aluminum tubes, heat treated to a T6 and T8 temper, were tested in combinations of tension-internal pressure and tension-torsion loading. Yield loci and flow behavior were determined for both modes of loading and compared to theoretical predictions. Both tempers of 2024 aluminum exhibited crystallographic textures and anisotropic yield and flow. Hill's quadratic yield criterion and the associated flow rule under-estimate balanced biaxial yield and flow, which is consistent with hydraulic bulge data on other face-centered cubic metals. Hill's nonquadratic criterion, which adds one additional parameter, and Bassani's criterion, which adds two parameters, predict the anisotropic yield behavior much more accurately. Predictions of the complete flow behavior, including strain paths, with these anisotropic criteria could be improved markedly by including provisions for planar anisotropy.

11368 Analysis of concentration profiles for fluxes, diffusion depths, and zero-flux planes in multicomponent diffusion. Dayananda, M.A. (Purdue Univ., West Lafayette, IN). *Metallurgical Transactions, [Section] A: Physical Metallurgy and Materials Science;* **14A**: 1851-1858(Sep 1983). Contract AC02-81ER10814.

Concentration profiles developed during isothermal, multicomponent diffusion for a single-phase, solid-solid diffusion couple are expressed on the basis of a relative concentration variable for each component and analyzed for the determination of interdiffusion fluxes. The individual concentration profiles intersect at a common cross-over composition where the relative concentrations of all components are identical. New relations are developed for describing internal consistency among the concentration profiles of the various components. A link is made between the cross-over composition and the depths of the diffusion zone on either side of the Matano plane for a diffusion couple. The cross-over composition is interpreted as the average relative concentration of each component over the diffusion zone. The identification of a zero-flux plane from concentration profiles is also described. The analysis offers several advantages in presenting as well as checking the self-consistency of results as illustrated with a single phase Cu-Ni-Zn diffusion couple annealed at 775°C.

11369 Flow localization accompanying the intergranular fracture of Ni_3Al. Schulson, E.M.; Davidson, D.L.; Viens, D. (Dartmouth Coll., Hanover, NH). *Metallurgical Transactions, [Section] A: Physical Metallurgy and Materials Science;* **14A**: 1523-1524(Jul 1983). Contract AC02-81ER10907.

Localized plastic flow that accompanies intergranular fracture within the strongly ordered $L1_2$ aluminide Ni_3Al is discussed. The work is part of a larger study on the brittle-to-ductile transition of this material, and was carried out to answer the question: is the plastic strain which accompanies the propagation of cracks along grain boundaries greater than that which occurs throughout the bulk of the aggregate? The question is a qualitative one and is answered by utilizing the qualitative aspects of the selected area channeling pattern (SACP) technique in scanning electron microscopy. The test material contained 25.0 at. pct Al (nominal) and was prepared by extruding to rod at 1260°C rapidly solidified powders.

11370 Deformation behavior of a 16-8-2 GTA weld as influenced by its solidification substructure. Foulds, J.R.; Moteff, J.; Sikka, V.K.; McEnerney, J.W. (Univ. of Cincinnati, OH). *Metallurgical Transactions, [Section] A: Physical Metallurgy and Materials Science;* **14A**: 1357-1366(Jul 1983).

Weldment sections from formed and welded type 316 stainless steel pipe are characterized with respect to some time-independent (tensile) and time-dependent (creep) mechanical properties at temperatures between 25°C and 649°C. The GTA weldment, welded with 16-8-2 filler metal, is sectioned from pipe in the formed + welded + solution annealed + straightened condition, as well as in the same condition with an additional re-solution treatment. Detailed room temperature microhardness measurements on these sections before and after reannealing enable a determination of the different recovery characteristics of weld and base metal. The observed stable weld metal solidification dislocation substructure in comparison with the base metal random dislocation structure, in fact, adequately explains weld/base metal elevated temperature mechanical behavior differences from this recovery characteristic standpoint. The weld metal substructure is the only parameter common to the variety of austenitic stainless steel welds exhibiting the consistent parent/weld metal deformation behavior differences described. As such, it must be considered the key to understanding weldment mechanical behavior.

11371 Evaluation of fracture toughness (J/sub IC/) using single specimen fracture test augmented by finite element analysis. Streit, R.D. (Lawrence Livermore National Lab., CA). *Journal of Engineering Materials and Technology;* **105**: 8-12(Jan 1983). Contract W-7405-ENG-48.

Fracture toughness is evaluated using the combination of results from a single compact tension fracture test and computationally developed key-curves. The key-curves - a family of load-deflection curves for the test specimen with different length cracks - were developed using the tensile flow properties of the material. By overlaying the experimental test results on these curves the crack length and crack growth during the test can be deduced. The value of J for each crack length is then evaluated from the experimental load-deflection data. The J versus crack extension curve is plotted and J/sub IC/ evaluated. The method is applied to the evaluation of the toughness of depleted uranium and is shown to substantially reduce the scatter often observed in the J versus Δa data.

11372 Initiation of single corrosion sites on iron by focused laser illumination. Ulrich, R.K.; Alkire, R.C. (Univ. of Illinois, Urbana). *Corrosion Science;* **23**: No. 11, 1153-1162(1983). Contract AC02-76ER01198.

An experimental method has been developed for selective depassivation of small regions on an otherwise passive metal surface with the use of a focused laser radiation. A nitrogen pumped dye laser provided a pulsed beam which was focused to a diameter of approximately 5 μm. The method was used to create corrosion sites on iron immersed in a solution of 0.1 M $Na_2B_4O_7$ containing NaCl in the range of 0.01 to 0.03 M. The corrosion rate was controlled by transport through a covering of corrosion products which precipitated over the site. The corrosion current from single sites increased with the square root of time, and with a proportionality factor that depended upon both the applied potential and chloride ion concentration. 8 references, 4 figures, 1 table.

11373 Between-heats charpy energy and initiation fracture toughness variation of SA533B-1. Oldfield, W.; Ellis, F.V. (Materials Research and Computer Simulation, Inc., Santa Barbara, CA). *American Society of Mechanical Engineers, [Paper];* No. 83-PVP-38, 1-6(1983).

A statistical analysis of CVN data together with chemistry and manufacturing date has been performed. The CVN energy data from nearly 600 heats of SA533B-1 steel was first analyzed by fitting a three-parameter hyperbolic tangent function to the data for each heat, to give coefficients defining the toughness transition behavior. This analysis was performed both for the energy data and for a function of the energy which provides a measure of fracture toughness. The coefficients were then related to chemistry and manufacturing date using regression procedures iteratively to evolve a statistically significant descriptive model. The results are presented graphically

11374 **Quantitative study of vacancy defects in quenched tungsten by combined field-ion microscopy and electrical resistometry.** Park, J.Y.; Huang, H.C.W.; Siegel, R.W.; Balluffi, R.W. (Argonne National Lab., IL). *Philosophical Magazine, [Part] A: Defects and Mechanical Properties;* **48**: No. 3, 397-419(1983).

A study of quenched, high-purity tungsten has been carried out with a combination of field-ion microscopy (FIM) and electrical resistivity measurements. It is concluded that the quenched-in vacancy defects observed by FIM are monovacancies and nearest-neighbour divacancies. From the partitioning during quenching between these two species, a divacancy binding enthalpy H/sub 2v// sup b/ $\sim$ 0.7 eV is deduced. A monovacancy resistivity of 7 x 10^{-4} Ω cm is obtained from the combined measurements. The quenched-in vacancy concentrations measured directly by FIM are consistent with previous results, if the total vacancy concentration at the melting temperature of tungsten (3695 K) is about 3 x 10^{-4} and the monovacancy formation enthalpy and entropy are 3.6 eV and 3.2k, respectively. The results are discussed in terms of the atomic-defect mechanisms for self-diffusion in tungsten.

11375 **Surface core-level shifts for Ge(100)-(2 x 1).** Miller, T.; Rosenwinkel, E.; Chiang, T.C. (Univ. of Illinois, Urbana). *Solid State Communications;* **47**: No. 11, 935-938(1983). Contract AC02-76ER01198.

Using surface-sensitive photoemission techniques, Ge 3d core-level binding energies for surface atoms of Ge(100)-(2 x 1) are found to be smaller than the bulk values by 0.41 eV. The surface atoms with shifted core-level binding energies correspond to one full (100) atomic layer. A surface core-exciton resonance is observed in the partial-yield measurements. The empty surface state involved in this excitonic transition, without binding-energy correction, is located at the valence-band maximum.

11376 **Comments on bonding processes during the dynamic compaction of metallic powders.** Gourdin, W.H. (Lawrence Livermore National Lab., CA). *Materials Science and Engineering;* **61**: 287-289(1983). Contract W-7405-ENG-48.

It is shown that the recent observations of Morris are consistent with an elementary model of energy deposition at powder particle surfaces during the passage of a compacting shock wave.

11377 **Correlation of acoustic and electrochemical noise in the stress-corrosion cracking of α-brass.** Newman, R.C.; Sieradzki, K. (Brookhaven National Lab., Upton, NY). *Metallurgia;* **17**: 621-624(1983). Contract AC02-76CH00016.

There have been several microscopic studies of transgranular stress-corrosion cracking (TGSCC) in α-brass. The first results of an investigation which aims to demonstrate the discontinuous nature of TGSCC in brass and to account for it in terms of the dynamics of competing plastic deformation and brittle crack growth are presented. By selecting a suitable combination of electrolyte and electrochemical potential, the sudden increments of crack growth are made visible in the form of anodic current transients. These are then correlated with acoustic emission.

11378 **Magnetism of the heavy 5f elements.** Huray, P.G.; Nave, S.E.; Haire, R.G. (Univ. of Tennessee, Knoxville). *Journal of the Less-Common Metals;* **93**: 293-300(1983). (CONF-830419—). Contract AS05-79ER10348;W-7405-ENG-26.

From 16. rare earth research conference; Tallahassee, FL, USA (18 Apr 1983).

Magnetic properties of the trivalent ions have been classically used to demonstrate the applicability of L-S coupling and Hund's rule to the 4f element series. An examination of similar behavior for the more spatially extended orbitals of the 5f element series has, until the last few years, been limited to lighter members (actinium through americium). Characterization of magnetic properties of heavier ions (curium, berkelium, californium and einsteinium) has recently led to a comparison with the 4f ion homologues of the actinides and to an extension of the test of L-S coupling to a new region of the periodic table. Investigations of the magnetic properties of heavy element compounds and metals have additionally led to some unexpected results which suggest a rich structure of low temperature magnetic ordering. The increasing degree of spatial localization of the heavy actinide orbitals thereby provides another vehicle for studying the theory of magnetic ordering via the conduction electrons.

11379 **Prediction of solid + liquid equilibrium diagrams for binary mixtures forming solid solutions with an extremum.** Brostow, W.; Macip, M.A. (Drexel Univ., Philadelphia, PA). *Materials Research Society Symposia Proceedings;* **19**: 217-222(1983). Contract AC22-82PC51006.

Convenient methods of correlation and prediction of S+L diagrams exist only for systems forming eutectics. To deal with solid solutions, the model of strictly regular solutions of Guggenheim was adopted. The key assumption is that values of the Gibbs function of interchange w are different in the two coexisting phases: w/sub S/ and w/sub L/. The assumption is based on the fact that the average interatomic distances anti-R are also different, and this affects the averages of the interatomic (or intermolecular) potentials. The input parameters are enthalpies and temperatures of melting of pure components and any pair of experimental points on the diagram. For a number of binary alloy systems the agreement with the experiment is good. Calculations were also made for organic mixtures, again with good results.

11380 **Chemical state investigation of grain boundary segregated sulfur in polycrytstalline nickel.** Hintz, M.B.; Heldt, L.A.; Clough, S.P.; Moulder, J.F. (Michigan Technological Univ., Houghton). *Scripta Metallurgica;* **17**: No. 12, 1415-1418(1983). Contract AC02-81ER10941.

The results of a combined Auger electron spectroscopic (AES) and X-ray photoelectron spectroscopic (XPS) study of the intergranular embrittlement of polycrystalline Ni by S are described. Largely as a result of AES investigations it is accepted that intergranular failure in most metals and alloys is caused by the segregation of impurities and/or alloying elements to the grain boundaries. Ni and many of its alloys are not exceptions. S segregation has been shown to result in embrittlement and enhanced susceptibility to hydrogen embrittlement in these materials. While AES has been useful in the detection and identification of segregated species, AES data provide little information on the chemical state of the detected elements. In contrast, XPS can often provide chemical state and chemical bonding information in addition to elemental detection and identification. XPS has been used extensively to characterize the chemical state of adsorbates on free surfaces but it has not been widely applied to the problem of intergranular segregation, due primarily to the lack of lateral resolution of the technique. As intergranular embrittlement mechanisms may be linked to the bonding state of segregated species, XPS analysis of segregated species may help elucidate the mechanisms involved.

11381 **Wetting of nickel by silver.** Nagesh, V.K.; Pask, J.A. (Lawrence Berkeley Lab., CA). *Journal of Materials Science;* **18**: 2665-2670(1983).

Sessile drop experiments of molten silver and nickel were performed in air and helium at 970°C. A NiO layer formed at the interface in air; silver formed a 90° contact angle on nickel. The role of solution reactions in forming these angles is discussed.

11382 **Tracer diffusion of Ge in Ni single crystals.** Mantl, S.; Rothman, S.J.; Nowicki, L.J.; Lerner, J.L. (Argonne National Lab., IL). *Journal of Physics F: Metal Physics;* **13**: 1441-1448(1983).

The diffusion of ^{68}Ge in single crystals of high-purity (over 99.99% pure) Ni has been measured using the sectioning technique. The plot of log D versus 1/T is straight from 939 to 1675 K, over

6 1/2 orders of magnitude in D, with parameters $D_0 = 2.10 +/- 0.47$ cm_2s^{-1}, $Q = 2.74 +/- 0.03$ eV ($264 +/- 3$ kJ mol^{-1}). The data suggest a low Ge-vacancy binding enthalpy for Ni.

11383 **Computer-simulated random-walk analysis of diffusion in dislocations.** Murch, G.E. (Argonne National Lab., IL). *Diffusion and Defect Data;* **32**: 1-8(1983). Contract W-31-109-ENG-38.

A general computer-oriented procedure, based upon the Monte Carlo method, is described for use in directing random walks, which in turn are used to solve phenomenologically-based diffusion problems. The method is demonstrated by considering the isolated dislocation pipe diffusion problem which has recently been studied by Le Claire and Rabinovitch. For the case of a thin-film tracer source it was found that tracer penetration plots, when expressed in a In[c] versus y form, have tails consisting of two linear regions with slopes which differ by about 15%. This result contrasts with the findings of Le Claire and Rabinovitch, where only one linear region is found.

11384 **Use of electrodeposition to provide coatings for solid state bonding.** Dini, J.W. (Lawrence Livermore National Lab., CA). *Welding Journal (Miami);* 33-39(Nov 1982). Contract W-7405-ENG-48.

The joining of dissimilar metals has widespread industrial application, particularly in the aerospace and nuclear industries. On occasion, metals to be joined cannot be welded or brazed because of metallurgical incompatibility. In addition, some metals may require a postjoining heat treatment that rules out brazing and welding. In such cases an alternative process that can be used is solid state bonding. The utilization of nickel and its alloys as plating materials on base metals to aid in the joining of nickel-base superalloys and in the joining of aluminum to the mild and stainless steels is discussed.

11385 **(DOUNREAY-TRANS—892) Irradiation-induced creep and swelling of austenitic material No. 1.4981 between 400 and 500°C (RIPCEX I).** Herschbach, K.; Schneider, W.; Ehrlich, K. Translated from *Journal of Nuclear Materials ;* **101**: 326-335(1981). 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85900013. DE85900013

The irradiation-induced volume swelling and creep in the temperature regime 400 to 500°C up to a dose of 63dpa max. was determined using nondestructive and destructive post-Irradiation experiments for material No. 1.4981. This shows a clear influencing of the volume swelling due to an applied stress. The irradiation-induced creep for the steel No. 1.4981 was brought about by at least two processes, one due to the so-called SIPA process which depends on the preferred absorption of interstitial lattice atoms, and the so-called I-Creep, a process which at the beginning after the onset of volume swelling can lead to yields. At higher doses the latter process is the dominant creep process.

11386 **(RISLEY-Trans—3168) Incubation time and cracking pattern in transcrystalline stress corrosion of austenitic chromium-nickel steels in magnesium chloride solutions.** Bleckmann, I.; Zitter, H. Translated from *Werkstoffe und Korrosion ;* **25**: No. 2, 93-97(1974). 13p. NTIS (US Sales Only), PC A02. File Number DE85900115. DE85900115

With a very sensitive elongation measurement, in the testing of an austenitic chromium-nickel steel (alloy number 4301) in 20 to 35% solutions of magnesium chloride, further details in the temporal progress of the elongation rate could be determined in comparison to known investigations. Accordingly, one can distinguish between the apparently undisturbed creep process, a discontinuous and a continuous crack growth. The incubation time determined experimentally depends on the sensitivity of the measuring method. The true incubation time is in any case shorter than the one determined experimentally. The existence of this can therefore be doubted as an easily detectable local activation already occurs when the load is applied. The incubation time determined from the elongation is followed by a discontinuous stage of demonstrable crack growth and repassivation which changes over into the known stage of a continuous crack propagation. This behavior is best explained by the sliding step-repassivation model.

3602 Ceramics, Cermets, And Refractories

REFER ALSO TO CITATION(S) 36020010840, 10981, 11181

11387 **(BNL—35564) Investigation of gap states in a-Si:H using dual beam photoconductivity and photoluminescence.** Vanier, P.E. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 5p. (CONF-8411133—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85005137.

From 11. Japanese seminar on properties and applications of amorphous semiconductors; Tokyo, Japan (26 Nov 1984).

A chopped bam of infrared (ir) photons can be used to modulate both the photoconductivity (PC) and the photoluminescence (PL) generated in a-Si:H by a steady primary beam of visible light. The dominant effects can be explained by the re-excitation of trapped charges into the bands (which causes an immediate enhancement of photocurrent and luminescence) followed by a slow redistribution of charge among the gap states (resulting in an increase in the recombination rate, and quenching of PL and PC).

11388 **(CONF-841117—35) Structure and properties of ion-implanted Al_2O_3.** McHargue, C.J.; Farlow, G.C.; White, C.W.; Appleton, B.R.; Angelini, P.; Naramoto, H. (Oak Ridge National Lab., TN (USA); Japan Atomic Energy Research Inst., Tokai, Ibaraki). 1984. Contract AC05-84OR21400. 18p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005374.

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

The effects of implantation parameters temperature (77 to 640 K), ion species (Cr, Zr, Nb, Al+O, Xe), and fluence (1×10^{14} to 1×10^{17} ions.cm^{-2}) on the structure and surface hardness of Al_2O_3 have been studied. Low temperatures favor the rapid accumulation of damage and formation of an amorphous layer. Except for zirconium, fluences in excess of 1×10^{17} ions.cm^{-2} are required to amorphize Al_2O_3 at 300 K. The amorphous phase has a hardness about 65% of that of the crystalline phase.

11389 **(CONF-841184—24) Neutron scattering investigation of magnetic excitations at high energy transfers.** Loong, C.K. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 24p. NTIS, PC A02/MF A02; GPO Dep. File Number DE85004069.

From 30. annual conference on magnetism and magnetic materials; San Diego, CA, USA (27 Nov 1984).

With the advance of pulsed spallation neutron sources, neutron scattering investigation of elementary excitations in magnetic materials can now be extended to energies up to several hundreds of MeV. We have measured, using chopper spectrometers and time-of-flight techniques, the magnetic response functions of a series of d and f transition metals and compounds over a wide range of energy and momentum transfer. In PrO_2, UO_2, $BaPrO_3$ and CeB_6 we observed crystal-field transitions between the magnetic ground state and the excited levels in the energy range from 40 to 260 MeV. In materials exhibiting spin-fluctuation or mixed-valent character such as $Ce_{.74}Th_{.26}$, on the other hand, no sharp crystal-field lines but a broadened quasielastic magnetic peak was observed. The line width of the quasielastic component is thought to be connected to the spin-fluctuation energy of the 4f electrons. The significance of the neutron scattering results in relation to the ground state level structure of the magnetic ions and the spin-dynamics of the f electrons is discussed. Recently, in a study of the spin-wave excitations in itinerant magnetic systems, we have extended the spin-wave measurements in ferromagnetic iron up to about 160 MeV. Neutron scattering data at high energy transfers are of particular interest because they provide direct comparison with recent theories of itinerant magnetism. 26 references, 7 figures.

11390 **(CONF-841246—11) Microstructural examination of fast-neutron irradiated Li_2O.** Liu, Y.Y.; Mattas, R.F.; Smith, D.L.; Porter, D.L. (Argonne National Lab., IL (USA)). Oct 1984. Contract W-31-109-ENG-38. 29p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85004814.

From 1. international conference on fusion reactor materials; Tokyo, Japan (3 Dec 1984).

Scanning Electron Microscopy examinations of fast-neutron irradiated Li_2O at 608 to 625°C to 1 and 3 at. % ^6Li burnups have been performed. Of particular interests are the helium bubble morphologies and their relationships to the reported tritium/helium retentions and swelling in Li_2O. Possible defect trapping of tritium is suggested, along with discussions of two other phenomena (microcracking, swelling) on the performance of an Li_2O fusion reactor blanket.

11391 **(DOE/CS/40442—T1) Hot wire thermal conductivity measurements in high temperature refractories.** Dils, R.R.; Allen, J.D.; Richmond, J.C.; McNeil, M.B. (National Bureau of Standards, Washington, DC (USA)). 1982. Contract AT01-81CS40442. 168p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85004516.

In the hot wire thermal conductivity test, a wire embedded in the material to be tested is heated with constant power input, and the temperature is measured at short time intervals. The thermal conductivity is computed from the known power input to the wire and the measured rate of increase in the wire temperature after about 700 s of heating. A finite-difference computer simulation of the hot wire test was developed to evaluate the effects of several variables in the properties of the materials tested and in the test procedures on the measured thermal conductivity. Equations relating the radiant heat transfer in a material to its optical properties were developed and a radiant heat transfer component was developed for the finite-difference simulation. Equations were derived to compute the spectral optical properties of a test material from the measured spectral normal-hemispherical transmittance of a sample of the material of known thickness that is thin enough to have a measurable transmittance over the wavelength range of about 500 to 20,000 nm, and the spectral near-normal hemispherical reflectance of a sample of the material thick enough to be completely opaque, over the same wavelength range. The optical extinction coefficient, and the ratio of the scattering coefficient, to the absorption coefficient, of MinK 2000 and K3000 brick were evaluated from their measured spectral transmittances and reflectances, and used to compute the radiant heat transfer component in these materials. The hot wire test measures an average thermal conductivity for all directions away from the wire in a plane normal to the wire. Extensive tests were made of MinK 2000 and K3000, and the measured values are compared to the guarded hot plate thermal conductivity, which is unidirectional normal to the face of a brick. 67 references, 31 figures, 23 tables.

11392 **(DOE/ER/04075—T3) Coupled diffusion phenomena. Final report.** Cooper, A.R. (Case Western Reserve Univ., Cleveland, OH (USA). Dept. of Metallurgy and Materials Science). Dec 1984. Contract AC02-76ER04075. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005478.

Research has been conducted at CWRU during the period 1976 to 1984 on the subject of coupled diffusion phenomena and its application to the continuous glassmaking process. Four related areas have been studied: (1) self-diffusion in fused silica and multicomponent silicate melts; (2) determination of thermodynamic activities of multicomponent silicate melts; (3) determination of multicomponent diffusion matrix D and study of dissolution kinetics and diffusion paths in such systems; and (4) application of this knowledge to obtaining a quantitative description of transport processes that occur in continuous glassmaking.

11393 **(UCRL—15648) Comparative sinterability of combustion synthesized and commercial titanium carbides.** Manley, B.W. (California Univ., Davis (USA)). Nov 1984. Contract W-7405-ENG-48. 66p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85006255.

The influence of various parameters on the sinterability of combustion synthesized titanium carbide was investigaged. Titanium carbide powders, prepared by the combustion synthesis process, were sintered in the temperature range 1150 to 1600°C. Incomplete combustion and high oxygen contents were found to be the cause of reduced shrinkage during sintering of the combustion syntheized powders when compared to the shrinkage of commercial TiC. Free carbon was shown to inhibit shrinkage. The activation energy for sintering was found to depend on stoichiometry (C/Ti). With decreasing C/Ti, the rate of sintering increased. 29 references, 16 figures, 13 tables.

11394 **Magnetic interactions, bonding, and motion of positive muons in magnetite.** Boekema, C.; Lichti, R.L.; Brabers, V.A.M.; Denison, A.B.; Cooke, D.W.; Heffner, R.H.; Hutson, R.L.; Leon, M.; Schillaci, M.E. (Texas Tech University, Lubbock, Texas 79409). *Physical Review [Section] B: Condensed Matter;* **31**: No. 3, 1233-1238(1 Feb 1985).

Positive-muon behavior in magnetite is investigated by the muon-spin-rotation technique. The observed muon relaxation rate in zero applied field, in conjunction with the measured local field, allows us to separate muon-motion effects from phase transitions associated with magnetite. The local magnetic field is observed to be 4.02 kOe directed along the <111> axis, the easy axis of magnetization. Possible origins of this field are discussed in terms which include local muon diffusion and a supertransfer hyperfine interaction resulting from muon-oxygen bonding. An anomaly in the muon hyperfine interactions is observed at 247 K.

11395 **Neutron scattering study of the pressure-induced phase transformation in ReO_3.** Axe, J.D.; Fujii, Y.; Batlogg, B.; Greenblatt, M.; Di Gregorio, S. (Brookhaven National Laboratory, Upton, New York 11973). *Physical Review [Section] B: Condensed Matter;* **31**: No. 2, 663-667(15 Jan 1985).

We have studied the pressure-induced phase transformation in a large single crystal of ReO_3 at 300 K and (0—6)-kbar hydrostatic pressure. Inelastic measurements at 1 bar show a pronounced minimum in the T_1 mode near the Brillouin-zone boundary (M point). Above P/sub c/ = 5.2 kbar superlattice reflections with intensities consistent with M_3-like rotations of ReO_6 octahedra appear. The transformation seems to be continuous (second order), but an anomaly in the superlattice intensity at P = 5.4 kbar suggests a further transformation. The M_3 phonon softens dramatically as P→P/sub c/ from below, but no substantial changes occur in the long-wavelength acoustic velocities between 0 and 6 kbar.

11396 **Behavior of electrical conduction of spinel and other insulating oxides in moderate electric fields at high temperature.** Sonder, E.; Weeks, R.A. (Oak Ridge National Lab., TN). *Journal of Applied Physics;* **56**: No. 8, 2365-2366(15 Oct 1984). Contract AC05-84OR21400.

It is known that MgO subjected to moderate electric fields at high temperature becomes progressively more conducting till it breaks down. We report a similar phenomenon in spinel. The insulating properties of stoichiometric spinel degrade even more rapidly than those of MgO; commercial spinel, which contains excess aluminum as well as hydrogen, exhibits erratic variations in conductance and general electrical instability, but does not always degrade to breakdown. Other insulating oxides (Al_2O_3, forsterite, quartz, and Y_2O_3) maintain their insulating properties when moderate dc electric fields (~ 1000 V/cm) are applied at temperatures near 1200°C.

11397 **Study of the Kondo effect and intrinsic electrical conduction in titanium diboride.** Williams, R.K.; Becher, P.F.; Finch, C.B. (Oak Ridge National Lab., TN). *Journal of Applied Physics;* **56**: No. 8, 2295-2302(15 Oct 1984). Contract AC05-84OR21400.

Electrical resistivity data for seven dense polycrystalline TiB_2 samples are reported. The data, which extend from 4.2 to 300 K, all show resistivity minima in the 34-47 K range and this is attributed to the Kondo effect. Although the residual resistivity values varied by only a factor of about 2, the strength of the Kondo effect changed by a factor of 15. These differences are related to the effects of processing variables. The ideal resistivity of TiB_2 was calculated from the measurements and was found to vary about as T^5 at low temperatures. These values can be adequately described by the Bloch-Grueneisen equation, and the characteristic temperature obtained from resistivity, 720 K, is in reasonably good agreement with the Debye temperature from specific heat measurements. A comparison of the electronic scattering part of the Bloch-Grueneisen constant shows that TiB_2 is a somewhat better conduc-

tor than Ti and the electronic band structures of ZrB_2 and Zr help to explain this difference.

11398 Diffusion of deuterium and hydrogen in rutile TiO_2 crystals at low temperatures. Chen, Y.; Gonzalez, R.; Tsang, K.L. (Oak Ridge National Lab., TN). *Physical Review Letters;* **53**: No. 11, 1077-1079(10 Sep 1984). Contract AC05-84OR21400.

It is demonstrated that diffusion of deuterons and protons in crystalline rutile, TiO_2, can be induced near room temperature by breaking of the O-H bond with electron irradiation and sweeping of these hydrogenic species along the c axis by an electric field.

11399 Electron microscopy investigation of the ZrO_2-ZrN system. II. Tetragonal and monoclinic ZrO_2 precipitation. van Tendeloo, G.; Anders, L.; Thomas, G. (Univ. of California, Berkeley). *Acta Metallurgica;* **31**: No. 10, 1619-1625(1983).

The ZrO_2-ZrN system (5-25%ZrN) has been shown to form a rhombohedral structure containing tetragonal monoclinic ZrO_2 precipitates of order 300 nm x 100 nm or smaller (Part I). The cyrstallographic characterisation of these features has been accomplished by using high resolution electron microscopy, convergent beam microdiffraction and laser optical microdiffraction. The orientation variants and habit planes have all been identified and these experimental results can also be deduced from group theory considerations.

11400 Stable and metastable phase equilibria and reactions in the SiO_2-αAl_2O_3 system. Pask, J.A. (Univ. of California, Berkeley). *Ceramics International;* **9**: No. 4, 107-113(1983). Contract AC03-76SF00098.

Procedures in the preparation of specimens in this system are critical due to the difficulty of nucleating αAl_2O_3 when the silicate liquid is not saturated with Al_2O_3 even though it may be supersaturated relative to crystalline αAl_2O_3, and the ease with which mullite growing from an alumino-silicate melt during cooling accommodates an excess of Al_2O_3. Metastable phase compositions and microstructures occur commonly. As a result, misinterpretation of experimental data have occurred in published reports. Stable and metastable phase equilibria diagrams in the αAl_2O_3-SiO_2 system are presented.

11401 Pre-eutectic densification in MgF_2-CaF_2. Hu, S.C.; De Jonghe, L.C.;. (Univ. of California, Berkeley). *Ceramics International;* **9**: No. 4, 123-126(1983). Contract AC03-76SF00098.

Increased densification rates were found as much as 200°C below the eutectic temperature (980°C) for MgF_2 containing small amounts of CaF_2. Constant heating rate and constant temperature sintering data, as well as microstructural developments indicated that solid state grain boundary transport rates had been enhanced by the eutectic forming additive. The effect saturated at about 1 wt% CaF_2. The results suggest that densification of ceramic powders could be favorably affected without a substantial increase in the grain growth rate, by the addition of small amounts of eutectic forming additives, and sintering below the eutectic temperature.

11402 Oxygen diffusion in uranium oxide: an overview. Murch, G.E. (Argonne National Lab., IL). *Diffusion and Defect Data;* **32**: 9-19(1983). Contract W-31-109-ENG-38.

In this overview, current understanding of the defect structure, the rate of oxygen mobility, and the mechanism of oxygen migration is evaluated. Stoichiometric UO_2, and both of the non-stoichiometric regions, UO/sub 2 + x/ and UO/sub 2 - x/, are considered. Further experiments which might aid in the understanding of the oxide are pointed out.

11403 Critical magnetic behavior of triuranium tetraphosphide U_3P_4. Troc, R.; Aldred, A.T. (Inst. for Low Temperature and Structure Research, Wroclaw, Poland). *Zeitschrift fuer Physik [Sektion] B: Condensed Matter and Quanta;* **53**: 295-299(1983).

The initial susceptibility and spontaneous magnetization of U_3P_4 single crystals were found to follow the simple power laws, described by the critical exponents γ, β and δ, whose values were established to be 1.19+/-0.01, 0.391+/-0.003 and 4.03+/-0.005, respectively. The Curie temperature of U_3P_4 determined in different ways is equal to (137.5+/-0.1)K. The obtained values of the critical exponents are exactly consistent with the scaling relation. In view of the extremely large magnetrocrystalline anisotropy present in U_3P_4, the above values are first compared to those of similar anisotropic materials and then discussed in terms of a three dimensional Ising system.

3603 Composite Materials

REFER ALSO TO CITATION(S) 36030011406

11404 (CONF-8410103—4) Particulate toughened silicon carbide. Janney, M.A. (Oak Ridge National Lab., TN (USA)). Oct 1984. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004797.

From Automotive technology development contractors' coordination meeting; Dearborn, MI, USA (29 Oct 1984).

The addition of TiC to hot-pressed SiC increased both strength and fracture toughness and also improved high-temperature strength. Good oxidation resistance was retained with samples showing only limited attack of the TiC phase. A processing study showed that the average strength and the Weibull modulus of hot-pressed SiC and SiC-TiC composites were sensitive to carbon source and milling. 11 references, 11 figures, 4 tables.

3604 Polymers And Plastics

REFER ALSO TO CITATION(S) 36040011072

3606 Other Materials

REFER ALSO TO CITATION(S) 36060010983, 10984, 10995, 11025, 11036, 11036, 11037, 11362, 11392, 11519, 11907, 11911

11405 (CONF-841157—44) Overheating and undercooling in silicon during pulsed laser irradiation. Larson, B.C.; Tischler, J.Z.; Mills, D.M. (Oak Ridge National Lab., TN (USA); Cornell Univ., Ithaca, NY (USA)). Dec 1984. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85004801.

From Symposium on the scientific basis for nuclear waste management; Boston, MA, USA (26 Nov 1984).

We have used time-resolved x-ray diffraction measurements of thermal expansion induced strain to measure overheating and undercooling in <100> and <111> oriented silicon during pulsed laser melting and regrowth. 249 nm (KrF) excimer laser pulses of 1.2 J/cm² energy density and 25 ns FWHM were synchronized with x-ray pulses from the Cornell High Energy Synchrotron Source (CHESS) to carry out Bragg profile measurements with +- 2 ns time resolution. Combined overheating and undercooling values of 120 +- 30 K and 45 +- 20 K were found for the <111> and <100> orientations, respectively, and these values have been used to obtain information on the limiting regrowth velocities for silicon.

11406 (CONF-841157—47) Time-resolved studies of rapid solidification in highly undercooled molten silicon. Lowndes, D.H.; Jellison, G.E. Jr.; Wood, R.F.; Pennycook, S.J.; Carpenter, R.W. (Oak Ridge National Lab., TN (USA)). Dec 1984. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85004857.

From Symposium on the scientific basis for nuclear waste management; Boston, MA, USA (26 Nov 1984).

A KrF (248 nm) pulsed laser was used to melt 90-, 190-, and 440-nm thick amorphous silicon layers produced by Si ion implantation into (100) crystalline Si substrates. Time-resolved reflectivity measurements at two different probe wavelengths (633 nm and 1.15 μm) and post-irradiation TEM measurements were used to study the formation of an undercooled liquid Si phase and the subsequent solidification processes. The time-resolved measuremetns provide new experimental information about the nucleation of fine-grained

Si crystallites in undercooled liquid Si, at low laser energy densities (E/sub l/), and about the growth of large-grained Si in the near-surface region at higher E/sub l/. Measurements with the infrared probe beam reveal the presence of a buried, propagating liquid layer at low E/sub l/. Model calculations indicate that this liquid layer is generated in part by the release of latent heat associated with the nucleation and growth process. 8 references, 4 figures.

11407 (CONF-841157—57) High resolution Z-contrast imaging and lattice location analysis of dopants in ion-implanted silicon. Pennycook, S.J.; Narayan, J.; Culbertson, R.J.; Fogarassy, E.; Batson, P.E. (Oak Ridge National Lab., TN (USA)). Dec 1984. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005261.

From Symposium on the scientific basis for nuclear waste management; Boston, MA, USA (26 Nov 1984).

Two new electron microscopy techniques have been developed which greatly extend the capabilities for the micro-characterization of semiconductors. The first is a technique for the direct imaging of dopants in semiconductors, whether or not they are in solution, using Z-contrast, and the second is a technique for determining the substitutional fraction of dopant. Both techniques are capable of nanometer spatial resolution and allow the detailed study of dopant segregation, precipitation, and clustering effects. 8 references, 8 figures.

11408 (DOE/ER/10453—04) Properties of glasses with high water content. Final report, June 14, 1979-September 14, 1983. Tomozawa, M.; Watson, E.B. (Rensselaer Polytechnic Inst., Troy, NY (USA)). 1983. Contract AC02-79ER10453. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005404.

Sodium silicate glasses containing 0 to 25 wt % dissolved water were synthesized and their chemical and physical properties were investigated. There are two types of water in these glasses: one type is hydroxyl SiOH, and the other is molecular water, H_2O. Dc conductivity at a constant temperature goes through a pronounced minimum as water content increases. The sodium diffusion coefficient follows approximately the dc conductivity. The correlation factor (Haven ratio) increases with increasing water content. The high-frequency dielectric constant increases slightly, while both the low-frequency dielectric constant and the dielectric relaxation strength pass through a pronounced minimum as water content increases. The refractive index goes through a maximum while density and hardness decrease with increasing water content and chemical durability deteriorates with increasing water content. The diffusion coefficient of H_2O in glass increases with added water. Radiation coloration by γ-rays and x-rays is suppressed by water in glass. The glass transition temperature decreases, while the thermal expansion coefficient increases with increasing water content.

11409 (IS-T—1163) Density of gap states in hydrogenated amorphous silicon. Yahya, E. (Ames Lab., IA (USA)). Jan 1985. Contract W-7405-ENG-82. 130p. NTIS, PC A07/MF A01; GPO Dep. File Number DE85005504.

Thesis.

Amorphous silicon hydride films have been grown by an improved rf sputtering method in a hydrogen-argon atmosphere. Deposition parameters such as substrate temperature, gas flow rate, rf power, and argon partial pressure were kept constant, while hydrogen partial pressure was varied. The infrared vibrational modes, optical absorption, conductivity, and density of gap states from the Fermi level upward toward the conduction band edge of these films have been studied as a function of hydrogen content of the films. The density of states distribution of the films has been deduced from Space Charge Limited Current measurements with an Au/a-Si:H Schottky diode structure. Samples with about 15.5% at. H have densities of states of 3×10^{14} states/cm^3 eV and show large majority carrier mobility-lifetime products of 10^{-5} cm^{2}V^{-1}. An Au/a-Si:H diode which is nearly ideal (diode quality factor = 1.05) was obtained for a-Si:H films with hydrogen concentrations of about 16 at. %. The experimental results indicate that a high quality a-Si:H material with a low density of states of 3×10^{14} states/cm^3 eV can be obtained by rf sputtering method. 62 references, 40 figures, 3 tables.

11410 (PNL-SA—12310) Effects of alpha irradiation on barium hollandite and nickel-iron spinel. Weber, W.J. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1984. Contract AC06-76RL01830. 9p. (CONF-841157—48). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004552.

From Symposium on the scientific basis for nuclear waste management; Boston, MA, USA (26 Nov 1984).

Barium hollandite and nickel-iron spinel have been irradiated with alpha particles emitted from a PuO_2 source in order to simulate the effects from alpha particles emitted in adjacent actinide-containing phases of the SYNROC assemblage. The unit cell of barium hollandite undergoes an apparent volume expansion of several percent and a weak transformation from a tetragonal to a monoclinic structure when irradiated with alpha particles to a fluence of 3×10^{30} alphas/m^2 (~ 0.05 dpa). The spinel structure, however, is very stable with respect to alpha irradiation and the irradiation-induced volume expansion of the unit cell is less than 0.2%. The results are compared with available neutron-irradiation data, and the differences in observed behavior discussed. 18 references.

11411 (SAND—84-0862C) Electronic properties of new organic conductors. Azevedo, L.J.; Venturini, E.L.; Kwak, J.F.; Schirber, J.E.; Williams, J.M.; Wang, H.H.; Reed, P.E. (Sandia National Labs., Albuquerque, NM (USA); Argonne National Lab., IL (USA)). 1984. Contract AC04-76DP00789. 11p. (CONF-841210—11). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005590.

From International chemical congress of Pacific Basin Societies; Honolulu, HI, USA (16 Dec 1984).

We have undertaken a study of the electronic properties of a new organic conductor, (BEDT-TTF)$_2$BrO$_4$, using magnetic resonance techniques and also the organic superconductor (BEDT-TTF)$_2$I$_3$. Proton magnetic resonance experiments on (BEDT-TTF)$_2$BrO$_4$ have resolved individual proton lines without the aid of line narrowing techniques. The electron spin resonance line is very narrow and shows a frequency independent low temperature broadening in the low temperature regime. The ESR broadening is strongly pressure dependent, being suppressed to lower temperature with the application of pressure. We have used radio frequency techniques to monitor the pressure dependence of the superconducting transition temperature, T/sub c/, in (BEDT-TTF)$_2$I$_3$ and find that T/sub c/ is suppressed to below 1K with the application of less than 0.5 kbar of pressure. In addition, we find a magnetic transition at 7K above a pressure of .5 kbar. 4 references, 7 figures.

11412 (SAND—84-1324C) Evidence for as doping effects on resolidification dynamics during pulsed laser melting. Thompson, M.O.; Peercy, P.S.; Tsao, J.Y. (Cornell Univ., Ithaca, NY (USA). Dept. of Materials Science; Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 7p. (CONF-841157—52). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005481.

From Symposium on the scientific basis for nuclear waste management; Boston, MA, USA (26 Nov 1984).

The effects of arsenic doping on the resolidification dynamics duirng pulsed melting of silicon with 694 nm laser irradiation has been studied using the transient conductance technique. At concentrations below 1 at. %, the incorporation of the As into the Si lattice results in negligible differences in the resolidification dynamics. At 7 at. % arsenic, however, the interface velocity is dramatically modified as the liquid-solid interface crosses the As containing region. These velocity changes are consistent with a reduced melting temperature in the As containing regions. For concentrations above 11 at. %, the depression in the melting temperature is sufficient to allow the surface to solidify while considerable melt remains buried within the sample. At 16 at. %, the melting temperature is sufficiently reduced to allow internal nucleation of melt prior to surface melting. 11 references and figures.

11413 (UCRL—90682) Computer simulations of rare earth sites in glass: experimental tests and applications to laser materials. Weber, M.J. (Lawrence Livermore National Lab., CA (USA)). Nov 1984. Contract W-7405-ENG-48. 15p. (CONF-840883—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85006156.

From International conference on defects in insulating crystals; Salt Lake City, UT, USA (20 Aug 1984).

Computer simulations of the microscopic structure of BeF_2 glasses using molecular dynamics are reviewed and compared with x-ray and neutron diffraction, EXAFS, NMR, and optical measurements. Unique information about the site-to-site variations in the local environments of rare earth ions is obtained using optical selective excitation and laser-induced fluorescence line-narrowing techniques. Applications and limitations of computer simulations to the development of laser glasses and to predictions of other static and dynamic properties of glasses are discussed. 35 references, 2 figures, 2 tables.

11414 Structure of dense shock-melted alkali halides: Evidence for a continuous pressure-induced structural transition in the melt. Ross, M.; Rogers, F.J. (University of California, Lawrence Livermore National Laboratory, Livermore, California 94550). *Physical Review [Section] B: Condensed Matter;* **31**: No. 3, 1463-1468(1 Feb 1985).

Hypernetted-chain equation calculations have been made for the ion-ion pair distribution functions in shock-melted CsI, CsBr, KBr, KCl, NaCl, and LiF. The results show that the melt undergoes a gradual pressure-induced structural change from an open NaCl-like structure with six nearest neighbors of opposite charge to one that has a rare-gas close-packed-like arrangement containing about 12 neighbors of mixed charge. These effects are most pronounced for the larger ions in which the short-range repulsions are stronger relative to long-range Coulomb attractions.

11415 Light-hole conduction in InGaAs/GaAs strained-layer superlattices. Schirber, J.E.; Fritz, I.J.; Dawson, L.R. (Sandia National Laboratories, Albuquerque, New Mexico). *Applied Physics Letters;* **46**: No. 2, 187-189(15 Jan 1985).

We report the first observation of light-hole band carriers in In/sub 0.2/Ga/sub 0.8/As/GaAs strained-layer superlattices by direct measurements of their effective mass (m*m/sub o/ = 0.14) using oscillatory magnetoresistance data. Preferential population of light-hole states, due to splitting of the degenerate bulk valence bands by built-in strain, allows this direct observation.

11416 Low-temperature ion beam mixing of Pt and Si markers in Ge. Kim, S.; Nicolet, M.; Averback, R.S.; Baldo, P. (California Institute of Technology, Pasadena, California 91109). *Applied Physics Letters;* **46**: No. 2, 154-156(15 Jan 1985).

The mixing of Pt and Si marker atoms in Ge during 750-keV Xe irradiation was measured at temperatures between 6 and 500 K. The low-temperature measurements show that the mixing parameter for Pt is nearly twice that for Si. This result is in strong contradiction to the collisional theory of ion beam mixing. A weak temperature dependence in the mixing is found for both markers.

11417 Local atomic structure of a clean surface by surface-extended x-ray absorption fine structure: Amorphized Si. Comin, F.; Incoccia, L.; Lagarde, P.; Rossi, G.; Citrin, P.H. (AT&T Bell Laboratories, Murray Hill, New Jersey 07974). *Physical Review Letters;* **54**: No. 2, 122-125(14 Jan 1985).

The application of near-edge surface, extended x-ray absorption fine structure to the study of a clean surface is reported. Direct evidence is found for surface recrystallization of ion-damaged (amorphized) Si, whereas no such evidence is seen for evaporated (amorphous) Si. The procedures described here are applicable to almost all clean or adsorbate-covered surfaces.

11418 NMR study of the chemisorption bond of carbon monoxide on platinum. Rudaz, S.L.; Ansermet, J.; Wang, P.; Slichter, a.C.P.; Sinfelt, J.H. (Department of Physics and Materials Research Laboratory, University of Illinois at Urbana-Champaign, Urbana, Illinois 61801). *Physical Review Letters;* **54**: No. 1, 71-74(7 Jan 1985). Contract AC02-76ER01198.

The authors report ^{13}C NMR studies of ^{13}Co adsorbed on small Pt particles and show that the data yield quantitative information about the CO-Pt bond. They find that the ^{13}C resonance position is shifted 200 ppm to higher frequency than in CO gas. They prove that the shift arises from polarization of the electron spins in the bond (a Knight shift) by showing that the spin-lattice relaxation obeys the Korringa law. Using ESR results from CO radicals, they deduce the local density of states of the CO 5σ orbital on the carbon atom at the Fermi energy. The NMR also reveals diffusion of CO on the Pt surface.

11419 Structure and thermal expansion in solid deuterium. Sokol, P.E.; Simmons, R.O.; Jorgensen, J.D.; Jorgensen, J.E. (Department of Physics and Materials Research Laboratory, University of Illinois at Urbana-Champaign, Urbana, Illinois 61801). *Physical Review [Section] B: Condensed Matter;* **31**: No. 1, 620-622(1 Jan 1985).

Neutron-diffraction measurements are reported on a strain-free polycrystalline deuterium sample with a J = 1 concentration x = 0.46 between 0.20 and 14.0 K. The lattice remains simple hcp down to the lowest temperature studied. No new reflections or changes in diffuse scattering are observed as the sample is cooled. The molar volume has been determined from the lattice constants. Our results are consistent with measurements of C/sub v/ and (partialP/partialT)/sub V/. Our diffraction data showed no evidence for a transition to a glassy phase as suggested by the NMR experiments.

11420 Josephson effect in $Lu_2Fe_3Si_5$: Evidence against triplet pairing. Noer, R.J.; Chen, T.P.; Wolf, E.L. (Ames LaboratoryU.S. Department of Energy and Department of Physics, Iowa State University, Ames, Iowa 50011). *Physical Review [Section] B: Condensed Matter;* **31**: No. 1, 647-649(1 Jan 1985).

The ac Josephson effect has been measured in a Nb/$Lu_2Fe_3Si_5$ point contact junction exposed to K-band microwave radiation. The step spacing corresponds closely to hf/2e, implying that $Lu_2Fe_3Si_5$ is an s-wave superconductor.

11421 Effect of pressure on the optical absorption edge of sulfur to 300 kbar. Peanasky, M.J.; Jurgensen, C.W.; Drickamer, H.G. (School of Chemical Sciences, Department of Physics and Materials Research Laboratory, University of Illinois at Urbana-Champaign, Urbana, Illinois 61801). *Journal of Chemical Physics;* **81**: No. 12, 6407-6408(20 Dec 1984). Contract AC02-76ER01198.

The optical absorption edge of sulfur has been measured to 300 kilobar pressure. A diamond anvil cell with ruby fluorescence for pressure calibration was used.(AIP)

11422 Summary of the Rigi-Kaltbad workshop on graphite. Green, W.V. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)); Smith, D.L. (Argonne National Lab., IL (USA)); Kelly, B.T. (Springfields Nuclear Power Development Labs. (UK)). *Journal of Nuclear Materials;* **122**: No. 1-3, 14-16(May 1984). (CONF-830942—).

From 3. topical meeting on fusion reactor materials; Albuquerque, NM, USA (19 Sep 1983).

CODEN: JNUMA.

Twenty international experts conducted a workshop within the framework of the International Energy Agency (IEA) on the question: Can graphite be included by designers in high power fusion reactors. The environment of the graphite was considered to include neutron doses greater than 50 dpa, temperatures from 600°C to an excess of 1200°C, cyclic temperatures and a flux of energetic particles escaping the plasma. The present is a summary of the workshop.

11423 Scaling up the neutral solution antireflection process. Wirtenson, G.R.; Brown, N.J.; Cook, L.M. (Lawrence Livermore National Lab., CA). *Optical Engineering;* **22**: No. 4, 450-455(Jul-Aug 1983). (CONF-821170—). Contract W-7405-ENG-48.

From Conference on laser induced damage in optical materials; Boulder, CO, USA (15 Nov 1982).

The neutral solution process (NSP) for chemically producing antireflection coatings has been scaled up from 24 cm and used successfully to treat components as large as 90 cm diameter. Since the process is primarily determined by diffusion through the surface, it has proven to be relatively insensitive to fluid flow effects which

influence the chemical concentration buildup at the surface. Large parts visually appear more uniform than small parts processed in model tanks. The major problems encountered have been associated with using plastic support components beyond their normal temperature limits and with handling parts to the required cleanliness outside of a clean room environment.

11424 **Bulk and surface damage thresholds of crystals and glasses at 248 nm.** Rainer, F.; Lowdermilk, W.H.; Milam, D. (Lawrence Livermore National Lab., CA). *Optical Engineering;* **22**: No. 4, 431-434(Jul-Aug 1983). Contract W-7405-ENG-48.

From 14. annual symposium on optical materials for high power lasers; Boulder, CO, USA (16-17 Nov 1982).

Twenty ns, 248 nm pulses were used to study surface and bulk damage in bare, polished samples of UV-transmitting glasses, fluoride crystals, and isomorphs of potassium dihydrogen phosphate (KDP). The intent was to test enough samples to establish the safe operating limits for currently available windows and crystals finished by routine techniques for optical fabrication. In fluoride crystals, thresholds for bulk inclusion damage and for rear-surface damage were comparable. The median rear-surface threshold was 16 J/cm^2. The fluence limit in fused silica windows was determined by the threshold for rear-surface damage, which ranged from 5 to 9 J/cm^2. For the isomorphs of KDP, the limiting fluenmce was the threshold for front-surface damage, which ranged from 3 to 9 J/cm^2.

11425 **Effect of heat treatment temperature (HTT) on density, weight and volume of glass-like carbon (GC).** Mehrotra, B.N.; Bragg, R.H.; Rao, A.S. (Univ. of California, Berkeley). *Journal of Materials Science;* **18**: 2671-2678(1983). Contract AC03-76SF00098.

Room temperature measurements have been made of the density, weight and linear dimensions of glass-like carbon (GC) that was heat treated in the temperature range of 1000 to 2700°C for three hours in inert gas atmosphere. The density of GC decreased with increase in heat treatment temperature (HTT), reaching a maximum decrease of 12.4% at 2700°C; and the weight loss increased with increasing temperature to a maximum of about 1.9%. The volume increased and showed a quadratic dependence on the HTT, reaching a maximum value of about 10.2%. Subsequent application of hydrostatic pressures up to 1551 MPa produced only a small increase in bulk density. It is concluded that the weight loss is not the major cause of the density decrease, instead the volume expansion of pores is mainly responsible for this behaviour. The weight loss is suggested to be due to the release of the last vestiges of hydrogen and the volume expansion is shown to be due to two different mechanisms operating in different temperature regimes. A gas pressure mechanism is predominant up to the HTT of 1600°C and at greater HTT thermal stress mechanism predominates. The irreversibility of the dimensional change is proposed to be due to the ratchet-like nature of microstructure that is developed during heating of the GC.

11426 **Dislocation charges in pure and Ca^{++}-doped KCl in the temperature range from 82 to 294 K.** Kataoka, T.; Colombo, L.; Li, J.C.M. (Univ. of Rochester, NY). *Radiation Effects;* **75**: 227-234(1983). Contract AC02-76ER02296.

The charge on edge dislocations was determined by two methods for KCl crystals doped with several concentrations of $CaCl_2$. In the first method, dislocation charges were measured by the potential difference developed between the side surfaces while a specimen was being compressed between tilted plates. The dislocation charge was found negative in Ca^{++} doped KCl and its magnitude increased with Ca^{++} concentration as well as temperature. In the second method, the dislocation produced at the surface scratch moved by the sole action of an electric field larger than a certain value. The dislocation charges were obtained from such critical field and the CRSS. The results agreed well with those obtained by the first method. A sweep-up mechanism for the edge dislocations to collect K^+ vacancies with thermally activated adsorption and desorption processes is proposed and found consistent with experimental observations.

40 CHEMISTRY

4001 Analytical And Separations Chemistry

REFER ALSO TO CITATION(S) 40010010974, 10986, 11021, 11464, 11635, 11732

11427 **(DOE/ER/13175—1) Study of Micellar-Enhanced Ultrafiltration. Progress report, March 1, 1984-February 28, 1985.** Scamehorn, J.F.; Christian, S.D. (Oklahoma Univ., Norman (USA)). Oct 1984. Contract AS05-84ER13175. 33p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85005585.

Micellar Enhanced Ultrafiltration (MEUF) has been shown to be an extremely effective method of removing dissolved organics from aqueous streams. In a model system with 4-tert-butylphenol as the dissolved organic, experimental rejections as high as 99.7% were observed with a permeate/feed ratio of 89% and good fluxes. Therefore, extremely low organic concentrations in the permeate are achievable with a small concentrate stream containing the dissolved organic in high concentrations. The nontoxic surfactant concentration in the permeate was observed to be 1 mM, a very low level. It is important to be able to predict the permeate purity in this process. In order to do that, comparison of the permeate composition to that expected under equilibrium conditions is useful. Very accurate solubilization (equilibrium) data for several solute-surfactant systems have been obtained using a vapor pressure technique for comparison to (future) MEUF data. However, organic solutes with low vapor pressures cannot be studied by using this method. Therefore, a new equilibrium dialysis method has been developed to measure solubilizations for these compounds. This will permit interfacing between MEUF experiments and solubilization measurements over a wide range of compounds. A study has been done on the advantages and disadvantages of using various classes of surfactants in MEUF. Considering solubilization capacities, micelle size, CMC, phase boundaries, and concentration polarization characteristics, cationic surfactants are considered the best candidate for most MEUF applications. 10 referenes, 17 figures.

11428 **(IS-T—1169) Selectivity variations in anion chromatography.** DuVal, D.L. (Ames Lab., IA (USA)). Jan 1985. Contract W-7405-ENG-82. 187p. NTIS, PC A09/MF A01; GPO Dep. File Number DE85005488.

Thesis.

Various organic acids are tested for use as eluents in single-column ion chromatography. Factors affecting their selectivity, sensitivity, and eluting strength are discussed. Coated anion exchange resins suitable for anion chromatography are also prepared. Their convenience, flexibility, and practical use as anion exchangers are demonstrated. Theories on ion exchange selectivity with high capacity ion exchange resins are reviewed. Interactions emphasized by each theory are pointed out as well as possible problems that could arise when applying these theories to explain selectivity variations found in anion chromatography. Previous studies in anion chromatography which exhibited selectivity variations are also reviewed and explanations for the variations are given. Parameters of the chromatographic system that could affect the selectivity of the system for various anions are investigated. Then, selectivity variations are explained in terms of interactions between components of the mobile phase and the stationary phase. Derivatization techniques necessary for species that are difficult or impossible to detect directly by anion chromatography are investigated. Methods are described for derivatizing cyanide and aldehydes in aqueous solution and then determining them by anion chromatography. 109 references.

11429 **(K/PS—864) Isotopic analysis of enriched/depleted SO_2 via low-resolution mass sectrometry.** Canada, D.C.; Kleven, B.E.; Campbell, R.J. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Aug 1984. Contract AC05-84OT21400. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85006488.

Governmental agencies are beginning to place increasing emphasis on the acid rain problem now plaguing the northeastern

United States. Sulfuric acid is the major component in the acid rain responsible for the high acidity. At present, very little scientific information exists concerning the atmospheric chemistry of sulfur compounds especially with regard to the kinetics of oxidation/hydrolysis of SO_2 to sulfate. In fact, simple knowledge of atmospheric plume dissemination is not well characterized. One proposed method of attacking these problems is via stable isotope tagging experiments (vis-a-vis, S^{34}/S^{32}). A number of enriched feed materials have been proposed for the study including SO_2, SF_6, CS_2, and S. In terms of simply tracing plume dispersion, any or all of these S^{34} enriched components could serve as a useful tracer. However, in terms of studying atmospheric chemical kinetics (i.e., $SO_2 \rightarrow$ sulfate), S^{34} enriched SO_2 will be the ideal feed material. The Oak Ridge Gaseous Diffusion Plant's (ORGDP) Centrifuge Division has recently run pilot plant enrichment experiments using both SO_2 and SF_6. This report describes the analytical determination of the isotopic composition of this enriched/depleted SO_2. The calculations and approximations for processing low-resolution mass spectrometric isotopic enrichment/depletion data are detailed for SO_2 molecular ion specie. 2 tables.

11430 (LA—9879-MS) Assay of plutonium metal by gamma spectrometry and calorimetry. Bowersox, D.F.; Wagner, R.P. (Los Alamos National Lab., NM (USA)). Nov 1984. Contract W-7405-ENG-36. 21p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005599.

The nondestructive assay of plutonium buttons containing 1 to 3 kg plutonium agrees within 0.2% of the value calculated by chemical assay. These buttons were 4 to 15% ^{240}Pu by weight and contained 100 to 10,000 ppM ^{241}Am. The nondestructive assay consisted of a gamma spectrometric determination of the isotopic distribution and a calorimetric determination of the power. Although further study is needed to extend the quantitative results to lower ^{240}Pu and ^{241}Am concentrations, the method is a rapid, nonintrusive technique for assaying plutonium.

11431 Review of applications of mass spectrometry to low level radionuclide metrology. Halverson, J.E. (Savannah River Ecology Lab., Aiken, SC (USA)). *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment;* **223**: No. 2/3, 349-355(15 Jun 1984). (CONF-830539—). Contract AC09-76SR00001.

From International meeting for radionuclide metrology - alpha particle spectrometry and low level measurement; Harwell, UK (10 May 1983).

Radiation counting of nuclear decay events is the most commonly used method of measuring radionuclide concentrations. However, some radionuclides, such as transuranics: ^{235}U, ^{236}U, ^{240}Pu, ^{242}Pu, and the fission products: ^{99}Tc and ^{135}Cs can be analyzed by mass spectroscopy with greater sensitivity, ease, and/or accuracy. Mass spectrometry also offers an independent means of measuring radionuclide concentrations which can be valuable as a comparison with radiation counting. Current capabilities of mass spectrometry for analysis of selected environmental radionuclides as well as projected developments for the near future are summarized. Comparisons of cost, sensitivity, and accuracy (with a particular emphasis on sensitivity) are made for those radionuclides of most interest to environmental studies and for those most likely to lend themselves to mass spectrometric analysis. In some cases where there are presently no mass spectrometric methods which are competitive with radiation counting, limiting factors are defined, and the possibility of future development is discussed. 35 refs.

11432 Rapid and precise alpha-particle spectrometry for plutonium materials. Matlack, G.M.; Bubernak, J. (Los Alamos National Laboratory, NM (USA). Chemistry Div.). *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment;* **223**: No. 2/3, 528-530(15 Jun 1984). (CONF-830539—).

From International meeting for radionuclide metrology - alpha particle spectrometry and low level measurement; Harwell, UK (10 May 1983).

Preparation of plutonium sources for alpha particle spectrometry is accomplished by extraction into a xylene solution containing 2-thenoyltrifluoroacetone, followed by evaporation of the xylene solution on a microcover glass, which is ignited briefly in a flame. This gives sources which display peak resolutions equivalent to 12 keV fwhm or less, and enables the spectrum to be accumulated with conversion ratios of proportional 35 keV/channel, enabling rapid data recording and processing. Relative precision and accuracies of $< 1\%$ in $^{238}Pu/^{239+240}Pu$ peak ratios can easily be achieved. The problem of minimizing pile-up background in the measurement of parts-per-million quantities of ^{236}Pu in ^{239}Pu can be solved by using quite short pulse widths from the shaping amplifier. This also permits the use of high total count rates to minimize the counting time.

11433 Investigations of ion-size-selective synergism in solvent extraction. McDoweli, W.J.; Case, G.N.; Aldrup, D.W. (Oak Ridge National Lab., TN). *Separation Science and Technology;* **18**: No. 14-15, 1483-1507(1983).

Organophilic crown ethers and other similar macrocylic compounds produce a synergistic enhancement of the extraction of several metal ions by organic-phase-soluble carboxylic, phosphoric, and sulfonic acids. Ions examined include the alkali metals, the alkaline earths, and some first-row transition elements. In many cases, the synergistic effects are clearly related to the correspondence of the size to the macrocycle cavity diameter. Occasionally, complete lack of synergism or even antagonism is observed. These phenomena have been investigated by systematic studies of the systems involved, by equilibrium studies of selected extraction systems, and by vapor-pressure osmometric studies of the intermolecular bonding between the organic-phase macrocycles and acids. Lack of synergism (when it is expected from size correspondence) does not appear to be due to bonding interactions between the macrocycle and the extractant acid. Other considerations suggest that synergism may depend on the degree to which the macrocycle can surround the ion. Possibilities for metal ion separation are noted, and the directions for further, needed investigations are indicated. 18 references, 14 figures, 2 tables.

11434 Kinetics and mechanism of the interfacial mass transfer of Zn^{2+}, Co^{2+} and Ni^{2+} in the system: bis(2-ethylhexyl)phosphoric acid, n-dodecane - KNO_3, water. Cianetti, C.; Danesi, P.R. (Argonne National Lab., IL). *Solvent Extraction and Ion Exchange;* **1**: No. 1, 9-26(1983). Contract W-31-109-ENG-38.

The mass transfer rate of Zn(II), Co(II) and Ni(II) between aqueous nitrate solutions and n-dodecane solutions of the organic soluble ligand HDEHP has been investigated using a forced convection, constant interfacial area stirred cell. The distribution ratios necessary to evaluate the kinetic experiments have been determined and the equilibrium constants which describe the heterogeneous complex formation reaction between Zn^{2+}, Co^{2+}, Ni^{2+} and HDEHP have been evaluated. The results have been interpreted according to two limiting models: 1) the mass transfer rate is controlled by slow reversible interfacial reactions, 2) the mass transfer is controlled by interfacial film diffusion. Both models are adequate to interpret the experimental data. The conclusion is reached that, if interfacial chemical reactions are rate controlling, rate constants of interfacial complex formation reactions independent of the nature of the cation are obtained. This result supports a reaction mechanism which is rate controlled by the microscopic diffusion of the cation through a viscous and structured layer of interfacial water adjacent to the liquid interface. 17 references, 7 figures, 1 table.

11435 Effect of liquid-phase diffusion resistance on retention time in gas-liquid chromatography. Huang, J.C.; Madey, R. (Kent State Univ., OH). *Analytical Chemistry;* **54**: No. 2, 326-328(Feb 1982). Contract AC02-80ER10622.

When gas chromatography is used to measure the retention time, it is generally assumed that the retention time of an infinitesimally small sample will correspond to the true thermodynamic value; however, it has been observed that the retention time decreases with increasing flow rate and that the retention time decreases as the thickness of the liquid layer increases. Previous models do not account for these phenomena. They arise from the diffusional resistance in the liquid phase which reduces the effective adsorption capacity. In this study, a model is proposed that assumes a nonuniform concentration for the liquid phase in order to include

the liquid-phase diffusional resistance. Also the model assumes that the gas-phase concentration is a function only of the column length. This assumption may not be true when the gas flow velocity varies with the radial coordinate, but it is approximately correct when the diffusional resistance in the liquid is more significant than that in the gas phase. 7 references, 2 figures.

11436 **(UCRL-Trans—12010) Indirect determination of rhenium by EDTA titration.** Hamaguchi, Hiroshi; Sugishita, Ryuichiro. Translated from *Bunseki Kagaku ;* **10**: 1256-1258(1961). Contract W-7405-ENG-48. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85001181. DE85001181

A reasonably rapid and accurate indirect determination of rhenium with EDTA was devised. Semimacro-amount of rhenium was precipitated as thallous perrhenate from a slightly acid or a neutral medium with 0.1N thallous nitrate solution. The precipitate was centrifuged and treated with hydrochloric acid and bromine to break up the precipitate and oxidize thallous ions. The thallic ions were then titrated at pH 5 with 0.01M EDTA standard solution using xylenol orange as an indicator. As little as 1 mg of rhenium can be readily determined within +- 1% relative error. Molybdate, permanganate, thiocyanate, bromate, iodate and halides interfere. Chlorate and perchlorate do not interfere. 8 references, 4 tables.

11437 **(ORNL-tr—5175) Identification of lignosulfonic acid and humic acid by pyrolysis, gas chromatography and mass spectrometry (Py-GC-MS).** Stieglitz, L.; Leger, W. (Oak Ridge National Lab., TN (USA); Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Heisse Chemie). [1985]. Contract AC05-84OR21400. Translation source information not available . 11p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005552.

Through the introduction of pyrolysis-gas chromatography, an important expansion of the range of application of gas chromatography to include low-volatile or non-volatile organic compounds has been attained. In this method, a macromolecule is broken down through heating into relatively low-molecular compounds, which can then be separated by common gas chromatographic analysis. The resulting gas chromatograms, or better pyrograms, are characteristic in appearance of the original substance. The original substance can thus be identified like with a fingerprint. The precondition for this method is of course the existence of reference pyrograms that have been made under identical conditions. Through the combining of gas chromatography with mass spectrometry, direct identification of the products of pyrolysis and thus of the individual building blocks of the macromolecule is possible. These techniques of analysis are applied to low-volatile water constituents to investigate the possibility of identifying lignosulfonic acid, its salts and humic acid. The experimental procedure and results are discussed. 9 figures, 3 tables.

4002 Inorganic And Physical Chemistry

REFER ALSO TO CITATION(S) 40020010835, 11434, 11458, 11459, 11460, 11461, 11462, 11465

11438 **(AD-A—147035/0/XAB) Application of quantum chemistry of atmospheric chemistry. Annual report, 1 October 1983-30 September 1984.** Krauss, M.; Stevens, W.J. (National Bureau of Standards, Washington, DC (USA). Quantum Chemistry Group). 30 Sep 1984. 15p. NTIS, PC A02/MF A01.

Relativistic effective potentials have been generated for a number of relevant metals such as iron, neodymium, and uranium and applied to calculations of the oxide electronic states including intermediate coupling calculations of the spin-orbit interaction.

11439 **(CONF-840767—16) Characterization of supported metal catalysts by imaging, microdiffraction and microanalysis techniques.** Dhere, A.G.; Reucroft, P.J.; De Angelis, R.J.; Bentley, J. (Kentucky Univ., Lexington (USA). Dept. of Metallurgical Engineering and Materials Science; Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005567.

From Microbeam Analysis Society analytical electron microscopy meeting; Bethlehem, PA, USA (16 Jul 1984).

It is the purpose of this paper to highlight and illustrate the techniques in analytical electron microscopy which can be used to study the structural and morphological features of the catalysts. The use of such techniques is increasing rapidly because of the great potential for characterizing the size, morphology, and structural defects in the metallic particles and also because of the contributions microanalysis can make to understanding interactions between the metal particles and the support materials. Certain limitations of these techniques are also discussed in reference to analysis of catalytic systems. The catalyst samples discussed in this paper are 11.9 % Ni/SiO_3, 14.2 % $Ni/MgSiO_3$, phosphorous-reduced colloidal gold, sodium-citrate-reduced colloidal gold, and C-150-1-01 catalyst supplied by United Catalyst containing approximately 52% nickel on a silica support. 12 references, 6 figures, 1 table.

11440 **(CONF-841105—59) Thermochemical modeling of the plutonium and uranium-plutonium dioxides.** Besmann, T.M.; Lindemer, T.B. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005360.

From Joint meeting of the American Nuclear Society and the Atomic Industrial Forum; Washington, DC, USA (11 Nov 1984).

The chemical thermodynamic properties of the actinide oxides have long been of interest for nuclear fuel design and for predicting fuel behavior under accident conditions. The result of such interest has been the publication of many studies over several decades containing thousands of measurements. The calcium fluorite structure <PuO/sub 2-x/> and <U/sub 1-z/Pu/sub z/O/sub 2-x/> phases have been intensely studied, with in excess of 1000 data points having been determined. The object of the current work is to develop quantitative models of <PuO/sub 2-x/> and <U/sub 1-z/Pu/sub z/O/sub 2-x/> which accurately describe the oxygen potential-temperature-composition behavior of the phases. The entire available data base of oxygen potential-temperature-composition values were extracted for use in the development of the models for the plutonia and mixed oxide phases. With perhaps the exception of Babelot et al., little effort has been made to utilize the large existing data base in such analyses. These data were instrumental in developing our models for the oxides, indicating the appropriate oxygen potential-composition relationships and providing for the determination of parametric values. The modeling approach used by us is fundamentally simple, utilizing the assumption that the complex oxides can be described as solutions of oxides with invariant stoichiometries. The chemical thermodynamic models for <PuO/sub 2-x/> and <U/sub 1-z/Pu/sub z/O/sub 2-x/> described here are among the first to make extensive use of the large oxygen potential-temperature-composition data base which exists for these systems. These relatively simple models should be easily applied to the design of fuel compositions the analysis of behavior during burnup, and the development of codes for accident analysis. 5 references.

11441 **(DOE/ER/06042—5) Properties of lanthanide oxides as supports for transition metal catalysts. Progress report, May 1, 1984-April 30, 1985.** Rosynek, M.P. (Texas A and M Univ., College Station (USA). Dept. of Chemistry). Jan 1985. Contract AS05-78ER06042. 39p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85006486.

The objective of this research has been to characterize the effect of support variations on the catalytic and surface properties of dispersed Group VIII transition metals. Particular emphasis has been placed on investigating behavior modifications induced by lanthanide oxide supports, in comparison to those of other, more conventional, support materials. Our investigations have focused primarily on support effects involving dispersed cobalt catalysts. Our results demonstrate that the nature of the support has a significant influence on the reduction and surface properties of dispersed cobalt. X-ray photoelectron spectroscopy (XPS) studies show that reduction in H_2 of SiO_2- supported $Co(NO_3)_2$, without prior calcination, results in considerable bulk metal formation, but that extensive monolayer regions of unreduced Co^{2+} species remain on the surface, even after treatment in H_2 at 500 to 700°C. If the supported $Co(NO_3)_2$ is converted to CoO/sub x/ by prior calcination, on

the other hand, subsequent treatment in H_2 results in essentially complete reduction to the zero-valent metal. On a TiO_2 support, cobalt is more easily reduced than on SiO_2, and on the lanthanide oxide supports La_2O_3, Eu_2O_3, and CeO_2, reduction occurs even more readily, but extensive additional interactions exist, particularly with CeO_2. 18 references, 13 figures, 1 table.

11442 (DOE/FE/60339—T7, pp 18-26) **Chemistry of carbonyl sulfide.** Tyrrell, J.; Hinckley, C.C.; Dunkerton, L.V. 26 Oct 1984. NTIS, PC A04/MF A01. File Number DE85000035.

In High-sulfur coal research at the SIUC Coal Technology Center. Quarterly report, July 1-September 30, 1984.

We intend to complete our analysis of the Ni(OCS) system (closed shell configuration) and to extend our calculations to the Ni(OCS) (triplet open shell) and Fe(OCS) (quintet open shell) systems. Calculations are also being initiated on Pt(OCS) and pd(OCS) systems. The objectives in the lanthanide project were to prepare lanthanide-monothiocarbamate complexes in quantity and then determine whether or not polymerization is a genral property. Preparation, characterization and reactivity of OCS and its metal complexes were also major objectives. Specifically, the reactions of metallic compounds with OCS are directed towards development and utilization of efficient regioselective oxidative addition reactions, including tandem reactions. Theoretical work has been completed on the Ni(OCS) closed shell system in which the nickel is bound to the carbon. An optimized geometry has been obtained and potential surface maps of the Ni(OCS) reaction have been obtained. Work is proceeding on the model in which nickel is bound to the sulfur. The triplet Ni(OCS) and quintet Fe(OCS) are well on the way to completion. Preliminary results are available on the closed shell Pt(OCS) system. Additional monothiocarbamate salts, and lanthanide complexes derived from them, have been prepared. We have determined that the polymerization of these compounds is general and includes the formation of gels in suitable solvents, e.g., pyridine. Pertaining to the reactivity of OCS and its metal complexes, additional results are available from the study of OCS ene reactions catalyzed by diethylaluminum chloride. Three ene substrates have been subjected to the reaction and the products characterized by spectral methods.

11443 (DOE/FE/60339—T7, pp 49-55) **Structure-sensitive catalytic dehydrogenation of hydrogen donor over iron sulfides: new methods for increasing coal depolymerization under mild conditions.** Smith, G.V.; Phillips, J.B. 26 Oct 1984. NTIS, PC A04/MF A01. File Number DE85000035.

In High-sulfur coal research at the SIUC Coal Technology Center. Quarterly report, July 1-September 30, 1984.

The objectives of this project are: to examine the mechanisms of hydrogen sulfide formation from iron sulfides; to explore the conditions for enhancement of in-situ hydrogen sulfide production in coal; and to study the conditions for stabilizing iron sulfide structures under reaction conditions. Progress has been amde on understanding the transient enhanced catalytic activity phenomenon.

11444 **(IS-T—1138) Synthesis and characterization of tetranuclear molybdenum iodide clusters.** Stensvad, S.M. (Ames Lab., IA (USA)). 1 Aug 1984. Contract W-7405-ENG-82. 121p. NTIS, PC A06/MF A01; GPO Dep. File Number DE85005312.

Thesis.

In this work, the thermolysis of $(R_4N)Mo(CO)_4I_3$, where R = Pr, Bu was examined. Depending on the reaction conditions, one of the following tetranuclear cluster anions was obtained: $Mo_4I_{11}^{2-}$, $Mo_4I_{11}^{2\ 5-}$, or $Mo_4I_{10}^{2-}$. The $Mo_4I_{11}^{2-}$ anion is best made by the reaction between a stoichiometric quantity of iodine and $(R_4N)Mo(CO)_4I_3$ in refluxing chlorobenzene. The x-ray crystal structure was determined for the black tetrabutylammonium salt, $(TBA)_2Mo_4I_{11}$. The structure of the $Mo_4I_{11}^{2-}$ anion is best viewed as a fragment of the $(Mo_6I_8)I_6^{2-}$ anion with metal atoms removed from cis cube faces. The resulting M_4 cluster has a distorted tetrahedral (butterfly) structure. There are five strong Mo-Mo bonds (anti d(Mo-Mo) = 2.567 A) and a long bond between the tip metal atoms (d = 3.035 A). A rough MO scheme was devised to explain the M-M bonding in the anion. This scheme predicted 6 bonding, 2 nonbonding, and 8 antibonding orbitals. Subsequent EHMO calculations performed by Miessner and Korolkov showed that the covalent nature of the Mo-I bondind in the $Mo_4I_{11}^{2-}$ anion has significant effects for the total bonding of the cluster. Their calculations predict 8 MOs with substantial M-M A0 character, and a slightly antibonding HOMO. The calculations also showed that the long Mo-Mo bond was due to a minimum in total bonding energy at a dihedral angle of 88.6° and not to any M-M bonding. The complete thermolysis of $(TBA)Mo(CO)_4I_3$ at 80°C, either in refluxing benzene or under a dynamic vacuum, yields $(TBA)_5(Mo_4I_{11})_3$. $(TPA)_2Mo_4I_{10}$ is synthesized by bubbling hydrogen or nitrogen gas through a $(TPA)Mo(CO)_4I_3$ thermolysis reaction. 48 references, 19 figures, 21 tables.

11445 **NO thermally desorbed from a saturation coverage on Pt(111): Internal state distributions.** King, D.S.; Mantell, D.A.; Cavanagh, R.R. (Center for Chemical Physics, National Bureau of Standards, Gaithersburg, Maryland 20899). *Journal of Chemical Physics;* **82**: No. 2, 1046-1048(15 Jan 1985).

Internal state distributions were obtained by laser-excited fluorescence for NO desorbing from a saturation coverage on Pt(111). Two major peaks are observed in the thermal desorption spectrum at crystal temperatures T/sub s/ = 200 and 340 K. The rotational state distributions for each desorption feature were Boltzmann, described by the rotational temperatures T/sub R/ = 195 +- 10 K and 305 +- 10 K, respectively. The two spin-orbit states were occupied to a degree consistent with equilibration between spin and rotational degrees of freedom, both Lambda doublet species were statistically populated and no molecular alignment was observed.

11446 **Dynamical corrections to transition state theory for multistate systems: Surface self-diffusion in the rare-event regime.** Voter, A.F.; Doll, J.D. (Chemistry Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Chemical Physics;* **82**: No. 1, 80-92(1 Jan 1985).

We derive an expression for the classical rate constant between any two states of a multistate system. The rate is given as the transition state theory rate of escape from the originating state, multiplied by a dynamical correction factor in the form of a time-correlation function which is evaluated using molecular dynamics techniques. This method is desiged to treat cases in which reactive state-change events are so infrequent (e.g., at low temperature) that direct molecular dynamics calculations are unfeasible. In this regime where dynamical recrossings occur much more quickly than the average time between reactive state changes, the concept of a rate between two nonadjacent states becomes meaningful. We apply the method to the surface diffusion of Rh on Rh(100) at the temperatures employed in field ion microscope experiments.

11447 **Improved potential energy surface for $F+H_2 \rightarrow HF+H$ and $H+H'F \rightarrow HF+H'$.** Brown, F.B.; Steckler, R.; Schwenke, D.W.; Truhlar, D.G.; Garrett, B.C. (Department of Chemistry, University of Minnesota, Minneapolis, Minnesota 55455). *Journal of Chemical Physics;* **82**: No. 1, 188-201(1 Jan 1985).

We present an improved analytic potential energy surface for the $F+H_2 \rightarrow FH+H$ and $H+FH' \rightarrow HF+H'$ reactions. The final surface is obtained in two stages. First we create a surface, called No. 4, which is based in the F—H—H barrier region on a previous partly empirical and partly theoretical fit and is based on the F—HxxxH exit channel and H—F—H barrier regions on new large-basis-set configuration interaction calculations. The final surface, called No. 5 incorporates more empirical information for collinear geometries in both the F—H—H and FHxxxH regions but remains a good representation of the ab initio calculations for bending potentials and in the strong-interaction regions. Variational-transition-state theory rate constants and WKB adiabatic barrier heights indicate that the final surface is more accurate than previous surfaces for thermal rate constants and overall reaction thresholds for $F+H_2 \rightarrow HF+H$, $F+D_2 \rightarrow DF+D$, and $F+HD \rightarrow HF+D$ and for product-state thresholds for HF ($n' = 3$) and DF($n' = 4$), where n' is the final vibrational quantum number.

11448 Quantum Monte Carlo study of the thermodynamic properties of argon clusters: The homogeneous nucleation of argon in argon vapor and "magic number" distributions in argon vapor. Freeman, D.L.; Doll, J.D. (Department of Chemistry, University of Rhode Island, Kingston, Rhode Island 02881). *Journal of Chemical Physics;* **82**: No. 1, 462-471(1 Jan 1985).

The thermodynamic properties of clusters of argon atoms are studied by a combination of classical and quantum mechanical Monte Carlo methods. The argon atoms are represented by Lennard-Jones interactions and internal energies, free energies, and entropies are calculated as a function of temperature and cluster size. For the argon system quantum effects and anharmonicity corrections are found to be simultaneously important for a temperature range from 15 to 20 K. By examining local minima in the free energy of formation of argon clusters as a function of cluster size, magic numbers in the Boltzmann mass distribution are observed at n = 7, 13, and 19 under some conditions of temperature and pressure. In some cases magic numbers are predicted in the quantum and not in the classical calculation. The entropy changes associated with cluster growth are found to be insensitive to cluster size. Quantum corrections are calculated to nucleation rates and found to be very important at low temperatures.

11449 Hydrogen chemisorption on transition metal clusters. Geusic, M.E.; Morse, M.D.; Smalley, R.E. (Rice Quantum Institute and Department of Chemistry, Rice University, Houston, Texas 77251). *Journal of Chemical Physics;* **82**: No. 1, 590-591(1 Jan 1985).

The dissociative chemisorption of H_2 on supersonic beams of Nb, Co, and Cu clusters is studied. (AIP)

11450 Bonding and ionization energies of N—F and P—F compounds. Berkowitz, J.; Greene, J.P.; Foropoulos J. Jr.; Neskovic, O.M. (Argonne National Laboratory, Argonne, Illinois 60439). *Journal of Chemical Physics;* **81**: No. 12, 6166-6175(20 Dec 1984). Contract W-31-109-ENG-38.

NF_3, N_2F_4, NF_2, PF_3, P_2F_4, PF_2, and PF_2I have been studied by photoionization mass spectrometry. Modified or confirmatory values have been obtained for the heats of formation of $NF^+{}_3$, $NF^+{}_2$, and NF^+ and the ionization potentials of NF_3 and NF_2. The stepwise bond energies are deduced to be $D^0{}_0(NF) = 3.27 +- 0.02$ eV; $D^0{}_0(FN—F) = 2.85 +- 0.02$ eV; and $D^0{}_0(F_2N—F) = 2.47 +- 0.01$ eV. Heats of formation at 0 K have been measured for $PF^+{}_2$ (89.6 +- 0.5 kcal/mol), PF^+ (< or =214.8 kcal/mol), and PF_2I (-142.3 +- 1.0 kcal/mol). The directly measured ionization potential of PF_2 is 8.85 +- 0.01 eV. The stepwise bond energies are found to be $D^0{}_0(PF)$

11451 Electron energy loss spectroscopy of H_2S adsorbed on Ni(100). Baca, A.G.; Schulz, M.A.; Shirley, D.A. (Materials and Molecular Research Divison, Lawrence Berkeley Laboratory and Department of Chemistry, University of California, Berkeley, California 94720). *Journal of Chemical Physics;* **81**: No. 12, 6304-6309(20 Dec 1984).

H_2S adsorption has been studied on Ni(100) at temperatures between 110—295 K by means of electron energy loss spectroscopy, low-energy electron diffraction and Auger spectroscopy. Coverage dependence of the H_2S adsorption has been studied at 110 K. At low coverages H_2S dissociates to S/sub ads/+H/sub ads/. At higher coverages two distinct molecular species are observed; H_2S with C/sub 2v/ symmetry (highest coverages) and either HS or H_2S with C/sub s/ symmetry (intermediate coverages). H/sub ads/ coexists with the two molecular species and S/sub ads/, and a H—Ni stretching frequency of 650 cm^{-1} suggests a four-fold hollow site for H/sub ads/. A saturation coverage is reached which produces a faint c(2 x 2) LEED pattern, and a comparison with D_2S is made at this coverage. The temperature-dependent spectra shown dissociation of the molecular species at ~170 K and H/sub ads/ recombining and leaving the surface at 220 K.

11452 Thermal electron attachment to van der Waals molecules containing O_2. Huo, W.M.; Fessenden, R.W.; Bauschlicher C.W. Jr. (Radiation Laboratory and Department of Chemistry, University of Notre Dame, Notre Dame, Indiana 46556). *Journal of Chemical Physics;* **81**: No. 12, 5811-5818(15 Dec 1984).

Calculations on O_2xN_2 and $O^-{}_2xN_2$ have been carried out to explain the large enhancement in the attachment rate of thermal electrons found in van der Waals molecules containing O_2. Two geometries, T-shape and linear, are used. SCF wave functions are used to represent both the neutral molecule and the ion. The incoming electron is approximated by a plane wave. The width is determined using a shielded polarization potential. The effect of additional vibrational structures of the van der Waals molecule on the attachment process is investigated by studying the O_2—N_2 stretching mode using Lennard-Jones potentials. Symmetry breaking, which allows the molecule to attach a p wave electron, is shown to play a primary role. The lowering of resonance energy, due to a deeper Lennard-Jones potential of $O^-{}_2xN_2$ in comparison with O_2xN_2, furthers the enhancement. The calculated attachment rate is comparable to that determined by Shimamori and Fessenden, but differs from the recent values obtained by Toriumi and Hatano, who used a different set of reactions to interpret their data.

11453 Review of deuterium triple-point temperatures. Schwalbe, L.A.; Grilly, E.R. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Physical and Chemical Reference Data;* **13**: No. 3, 687-693(Jul 1984).

A review is presented of the existing measurements of the triple-point temperatures T/sub tp/ of deuterium. All data are adjusted to a common temperature scale, and error limits are proposed where none was provided in the source publications. The effects of sample contamination are also considered. Impurity corrections, based on estimates from vapor-pressure measurements, are applied to the results. The analytical representation T/sub tp/(x) = 18.680+0.155x, where x is the fraction of p-D_2 (J = 1), is found to represent T/sub tp/ to +- 0.010 K. The value, 18.723 +- 0.010 K, measured most recently on normal deuterium is consistent with the most accurate and precise of the earlier data.

11454 Isopiestic studies of aqueous solutions at elevated temperatures. VII. $MgSO_4$ and $NiSO_4$. Holmes, H.F.; Mesmer, R.E. (Oak Ridge National Lab., TN). *Journal of Chemical Thermodynamics;* **15**: 709-719(1983). Contract W-7405-ENG-26.

Isopiestic measurements have been performed using aqueous solutions of $MgSO_4$ and $NiSO_4$ at 383.14 K with NaCl serving as the reference electrolyte. Irreversible solubility effects prevented successful measurements at higher temperatures. Osmotic coefficients at 383.14 K are smaller and less dependent on molality than at 298.15 K. The ion interaction model, as modified for 2-2 electrolytes, was fitted to the osmotic coefficients. Only three of the four parameters of the model could be evaluated, thereby precluding the direct calculation of activity coefficients from the isopiestic results. Combination of the present results with published freezing temperatures and enthalpies does permit the computation of activity coefficients in the case of $MgSO_4$. At 383.15 K the activity coefficient of $MgSO_4$ becomes quite small (<0.05) at very moderate molalities (0.5 mol x kg^{-1}). Because of uncertainties in the calculations only general observations concerning trends in the activity coefficient at elevated temperatures and high molalities are warranted. 34 references, 2 figures, 5 tables.

11455 Neutral and charged clusters in the atmosphere: their importance and potential role in heterogeneous catalysis. Castleman, A.W. Jr. (Univ. of Colorado, Boulder). *Heterogeneous Atmospheric Chem.;* **26**: 13-27(1982). Contract AC02-78EV04776.

Extensive investigations of the bonding of atmospherically important molecules to various ions have been made, and the results are used to clarify the overall gas-to-particle conversion process involving a single ionic species. Neutral and charged clusters play an important role in atmospheric processes, and an understanding of their states and reactivity is essential in developing a fundamental understanding and basis for assessing the importance of het-

erogeneous processes. The purpose of this paper is to survey briefly the current knowledge in these various fields and to recommend studies needed for further progress in quantifying aerosol formation and catalytic reactivity. The topics surveyed include clusters between ions and molecules and among neutral molecules, bonding and stability of small neutral-neutral complexes and related charge transfer complexes, and gas-to-particle conversion. 92 references, 5 figures, 2 tables.

11456 **Consideration of the role of sintering in gas-solid interactions.** Munir, Z.A. (Univ. of California, Davis). *Thermochimica Acta;* **48**: 91-97(1981). Contract AM03-76SF00034.

An analysis of the role of sintering in gas-solid interactions involving particulate materials is presented. Application of this analysis to decomposition and sintering data for calcium carbonates demonstrates that changes in the porosity caused by sintering proceed at too low a rate to have a significant effect on the decomposition process for this material. For reactions with mass-transport control it is shown that sintering can have a more direct influence on the decomposition rates.

11457 **Thermal decomposition of cadmium and cobalt carbonates.** Munir, Z.A.; Rice, J.L. (Univ. of California, Davis). *High Temperature Science;* **14**: 171-180(1981). Contract AM03-76SF00034.

The dissociation pressures of $CdCO_3$ and $CoCO_3$ were determined by the torsion-effusion method. A strong dependence of the measured pressures on orifice size was observed in both cases. Utilization of the Whitman-Motzfeldt analysis gave the following expressions for the dissociation pressures of these two compounds: $CdCO_3$: log P(atm) = (9.126 +/- 0.295) - (6.933 +/- 0.296)10^3(1/T); $CoCO_3$: log P(atm) = (5.93 +/- 0.20) - (5.00 +/- 0.20)10^3(1/T) where the equations apply for the range 548-592 K for $CdCO_3$ and 547-586 K for $CoCO_3$. Third and second law $\Delta H_{298}°$ for the $CdCO_3$ decomposition were found to be 125.4 and 136.3 +/- 6.3 kJ/mol, respectively. The second law enthalpy of decomposition of $CoCO_3$ at T = 567 K was calculated to be 95.7 +/- kJ/mol.

4003 Organic Chemistry

REFER ALSO TO CITATION(S) 40030010850, 11434, 11439, 11444, 11471, 11773

11458 **(DOE/PC/60812—T3) Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 1, October-December 1983.** Massoth, F.E.; Shabtai, J.S. (Utah Univ., Salt Lake City (USA). Dept. of Fuels Engineering). 9 Jan 1984. Contract FG22-83PC60812. 14p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004237.

The aim of the proposed research is to synthesize and investigate new sulfided catalyst systems having higher carbon-heteroatom hydrogenolysis activity as compared to ring hydrogenation activity. A fundamental approach is planned to gain understanding of the basic catalytic properties which relate to hydrogenolysis, hydrogenation and cracking functions of the catalysts. This will involve preparation of new catalysts, characterization of their properties and model compound reactivity studies. In another part of the project, selected catalysts will be applied in studies of more complex O- and N- containing model compounds with the objective of providing fundamental data on the stereochemistry of HDO and HDN reactions. These data will be used to develop steric surface-reactant models for sulfided catalysts. During this quarter additional catalysts were prepared by incipient wetness impregnation using solutions at various pH levels. Catalysts prepared by this method included: 3% and 6% Co, or 3% and 6% Ni with either 8% Mo or with 4.5% Cr supported on γ alumina. Five catalysts were tested for hydrodeoxygenation (HDO) and hydrodenitrogenation (HDN) activity using model compounds indole and dibenzofuran. 5 references, 5 figures, 1 table.

11459 **(DOE/PC/60812—T4) Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 4, July-September 1984.** Massoth, F.E.; Shabtai, J.S. (Utah Univ., Salt Lake City (USA). Dept. of Fuels Engineering). Oct 1984. Contract FG22-83PC60812. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85004233.

The aim of the proposed research is to synthesize and investigate new sulfided catalyst systems having higher carbon-heteroatom hydrogenolysis activity as compared to ring hydrogenation activity. A fundamental approach is planned to gain understanding of the basic catalytic properties which relate to hydrogenolysis, hydrogenation and cracking functions of the catalysis. This will involve preparation of new catalysts, characterization of their properties and model compound reactivity studies. In another part of the project, selected catalysts will be applied in studies of more complex O- and N- containing model compounds with the objective of providing fundamental data on the stereochemistry of HDO and HDN reactions. These data will be used to develop steric surface-reactant models for sulfided catalysts. The research is divided into four tasks: A-catalyst preparation and activity testing; B-catalyst characterization; C-study of catalyst activity and functional selectivity under hydroprocessing conditions; and D-stereochemical studies. Two series of Al_2O_3-supported Ru, Rh, Pd and Re catalysts were prepared. In one of the series a high concentration, viz., 7.72 x 10^{-2} g atom of the noble metal/100 g of γ-Al_2O_3 was used, whereas in the second series the level of the noble metal was reduced to 1/8 of this concentration. The catalysts were subjected to activity and functional selectivity studies under Task C, and to stereochemical studies under Task D. Characterization studies under Task B are in progress. 1 figure, 4 tables.

11460 **(DOE/PC/60812—T5) Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 3, April-June 1984.** Massoth, F.E.; Shabtai, J.S. (Utah Univ., Salt Lake City (USA). Dept. of Fuels Engineering). Jul 1984. Contract FG22-83PC60812. 16p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85004234.

The aim this research project is to synthesize and investigate new sulfided catalyst systems having higher carbon-heteroatom hydrogenolysis activity as compared with ring hydrogenation activity. A fundamental approach is being applied to gain understanding of the basic catalytic properties which relate to hydrogenolysis, hydrogenation and cracking functions of the catalysts. This involves preparation of new catalysts, characterization of their properties and model compound reactivity studies. In another part of the project, selected catalysts are being applied in studies of more complex O- and N- containing model compounds with the objective of providing fundamental data on the stereochemistry of HDO and HDN reactions. These data will be used to develop steric surface-reactant models for sulfided catalysts. Supported noble metal catalysts containing Rh and Pd were prepared by incipient wetness impregnation of γ-Al_2O_3 using nitrate solutions. Catalysts containing also Co and Cr were similarly prepared. Catalyst activities for HDO and HDN were evaluated using the model compounds dibenzofuran and indole. Characterization work by ESCA and oxygen chemisorption, of CoMo catalysts, and stereochemical studies with several catalysts were also initiated. 15 references, 1 figure, 3 tables.

11461 **(IS-T—1131) Synthesis and reactivity of heterodinuclear iron, ruthenium, and cobalt compounds containing bridging dithiomethylene ligands. Attempted synthesis of the iron carbyne compound $Cp(CO)FeCSCH_3$.** Matachek, J.R. (Ames Lab., IA (USA)). Jan 1985. Contract W-7405-ENG-82. 151p. NTIS, PC A08/MF A01; GPO Dep. File Number DE85005611.

Thesis.

This dissertation is divided into two parts. Part I describes the synthesis and characterization of a series of dinuclear transition metal complexes containing bridging dithiomethylene ligands. The reaction of these compounds toward various nucleophiles and oxidizing agents is also presented. Conclusions are drawn about the structure and reactivity of these compounds based on the results of a molecular orbital calculation. Part II of this dissertation describes the attempted synthesis of the iron carbyne (iron carbon triple bond)-containing compound $Cp(CO)FeCSCH_3$. Although unsuccessful this study resulted in the synthesis of several new com-

pounds containing iron carbon bonds and resulted in developing a new synthetic route to $Cp(CO)Fe[S_2CSCH_3]$. 148 references, 9 figures, 9 tables.

11462 (IS-T—1167) Simple molybdate selective oxidation catalysts containing excess MoO_3 for C_4 hydrocarbon oxidation to maleic anhydride. Ozkan, U.S. (Ames Lab., IA (USA)). Jan 1985. Contract W-7405-ENG-82. 199p. NTIS, PC A09/MF A01; GPO Dep. File Number DE85004793.

Thesis.

In this research $NiMoO_4$ and $CoMoO_4$ selective oxidation catalysts with excess MoO_3 have been investigated in regard to their catalytic performance in C_4 hydrocarbon conversion to maleic anhydride. Routes have been established for the synthesis of pure molybdates; incorporation of excess MoO_3 into these catalysts have been accomplished using three different preparation techniques, namely, precipitation, solid state reaction and impregnation. Extensive characterization of the catalysts has been performed using complementary instrumentation techniques such as surface area measurements, x-ray fluorescence, x-ray diffraction, laser Raman spectroscopy, Raman microprobe spectroscopy, scanning electron microscopy, energy dispersive x-ray analyzer, and x-ray photoelectron spectroscopy. It has been shown that these catalysts exhibit a two-phase nature with distinct particles of $NiMoO_4$ and MoO_3 existing together. The formation of a solid solution or the formation of new nickel- (or cobalt-) molybdenum-oxygen compounds have been shown not to occur. Characterization investigations have indicated that a specific state of association of the particles was crucial: the surface of MoO_3 crystallites was covered or decorated with $NiMoO_4$. Kinetic investigations have been performed on these catalytic systems using a continuous, fixed bed integral reactor system for selective oxidation of C_4 hydrocarbons to maleic anhydride. Butene oxidation studies have shown that pure MoO_3 and pure $NiMoO_4$ are completely nonselective for maleic anhydride formation whereas catalysts which contain excess MoO_3 have a high selectivity for maleic anhydride which is accompanied by a sharp drop in CO/sub x/ selectivity. 101 references.

11463 (PNL-SA—10350(2)) Formation of dimethylbenzenediol via acyloin condensation and a reduction-oxidation pathway. Nelson, D.A.; Landsman, S.D.; Molton, P.M. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1983. Contract AC06-76RL01830. 9p. NTIS, PC A02. File Number DE85005527.

Interest with benzenediol formation was initiated by the isolation and identification of 2,5-dimethyl-1,4-benzenediol from the liquefaction product of cellulose. During that same work 2,5-dimethyl-2,5-cyclohexadiene-1,4-dione(1), 2,3-butadione (biacetyl) and 3-hydroxy-2-butanone (acetoin) were also detected as liquefaction products under aqueous alkaline conditions. Several alkylbenzenediols have been isolated as alkaline degradation products of xylose and glucose, while 1 was observed after alkali treatment of sucrose. Early work had indicated that both 1 and 2,5-methyl-1,4-benzenediol, (2), could be prepared by warming 10g of biacetyl in 200 ml of dilute caustic solution. However, yield information was given only for the product of 2,3-pentadione (10% of 2,5-diethyl-2,5-cyclohexadiene-1,4-dione). Results with biacetyl under similar conditions suggested that the yields of 1 and 2 were in the 1 to 5% range depending upon reaction time; i.e. 0.75 hr was required for 1% 1 while 4 hrs were required for 5% 1. When acetoin was subjected to similar conditions neither 1 or 2 were detected during the initial 4 hr.

11464 (RFP—3685) Bifunctional organophosphorus liquid-liquid extraction reagents: development and applications. Schulz, W.W.; Navratil, J.D. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 13 Mar 1984. Contract AC04-76DP03533. 21p. (CONF-840415—27). NTIS, PC A02/MF A01; GPO Dep. File Number DE85004970.

From 187. national meeting of the American Chemical Society; St. Louis, MO, USA (8 Apr 1984).

American and Russian workers have evidenced great interest in the last decade in the potential application of certain neutral and acidic bifunctional organophosphorus compounds in solvent extraction processes. Triggering this interest is the ability of some carbamoylmethylenephosphorus (CMP) and carbamoylmethylenephosphine oxide (CMPO) compounds to extract trivalent actinides and lanthanides from strong HNO_3 (>1M) solutions, a property which distinguishes them from monofunctional organophosphorus reagents. Investigators at several US Department of Energy laboratories have concentrated on synthesis of novel CMP and CMPO reagents and on reactions and mechanisms involved in extraction of metal ions from aqueous nitrate media; application of selected CMP and CMPO reagents in solvent extraction and supported liquid membrane recovery of metal values from nuclear waste solutions have been proposed. This paper, based upon a book now in preparation, provides a brief overview of the current status of the development and application of bifunctional organophosphorus extractants. 42 references, 4 tables.

11465 Viscosity of carbon-monoxide mixtures with four gases in the temperature range 25-200°C: supplement. Kestin, J.; Ro, S.T. (Brown Univ., Providence, RI). *Berichte der Bunsengesellschaft fuer Physikalische Chemie;* **87**: 600-602(1983). Contract AC02-81ER10811.

New, absolute measurements of the viscosity of carbon monoxide (CO) with krypton (Kr), carbon dioxide (CO_2), methane (CH_4) and carbon tetrafluoride (CF_4) are reported. The measurements were carried out in an oscillating-disk viscometer at a pressure of 0.1 MPa in the temperature range 25-200°C. The accuracy is estimated to lie between +/-0.1% and +/-0.2%. The data were correlated by means of the two-parameter extended law of corresponding states. They were utilized to derive binary diffusion coefficients. This paper is a supplement to an earlier publication on mixtures with He, Ne, Ar, and N_2. The great similarity between the viscosity of binary mixtures with N_2 and CO respectively, is confirmed to a high degree of accuracy.

4004 Electrochemistry

REFER ALSO TO CITATION(S) 40040011474

11466 Voltammetric study of the anodic oxidation of sulfide ions in molten fluorides. Minh, N.Q.; Yao, N.P. (Argonne National Lab., IL). *Journal of the Electrochemical Society;* **130**: No. 5, 1025-1029(May 1983).

The electrochemical oxidation of sulfide has been studied in LiF-NaF eutectic by linear sweep voltammetry using graphite electrodes at 1023 K. The oxidation is found to be reversible and diffusion controlled. A detailed analysis of the experimental results suggests the following mechanism for the oxidation of sulfide ions $2S^{2-} \rightleftharpoons S_2^{2-} + 2e^-$. The average apparent diffusion coefficient for sulfide ions is calculated to be 1.47×10^{-5} cm²/sec at 1023 K. 34 references, 4 figures, 1 table.

4005 Photochemistry

REFER ALSO TO CITATION(S) 40050011372

11467 (CONF-8411100—3) Multiphoton ionization and excitation of fluoranthene and benzene in solution. Faidas, H.; Siomos, K.; Christophorou, L.G. (Oak Ridge National Lab., TN (USA); Tennessee Univ., Knoxville (USA)). 1984. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005236.

From International conference on applied lasers and electro optics; Boston, MA, USA (12 Nov 1984).

Multiphoton ionization and excitation spectra of fluoranthene and benzene in dilute solutions of n-pentane have been measured utilizing, respectively, a sensitive multiphoton conductivity and a two-photon excitation technique. The order of the multiphoton ionization process in benzene solutions has been determined, and its significance in the determination of the ionization threshold of benzene in solution is discussed. The potential capability of the multiphoton ionization technique to laser-analytical instrumentation in the liquid phase is indicated. 12 references, 3 figures.

11468 (DOE/ER/10366—5) Sensitization and quenching in the conversion of light energy into chemical energy. Final report. Cristol, S.J. (Colorado Univ., Boulder (USA)). 28 Dec 1984. Contract AC02-79ER10366. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85006301.

The original proposal dealt with a set of problems related to intermolecular energy transfer rates in sensitization and quenching, testing of a variety of methods of measurement of lifetimes of excited-state species. During the past five years some of the initial goals of the proposal were attained. We did not do enough work to arrive at substituent constants for photochemical reactions of aromatic compounds, but we did succeed in measuring a number of lifetimes of singlets by a novel double-quenching technique and of triplets produced by photosensitization. We discovered a novel sensitization relay mechanism for energy transfer. A share of our effort was redirected to look at the factors involved in excitation (energy and electron) transfer within a molecule. It is clear that the requirements for facile electron-transfer are yet to be defined. At present most workers are, at best, able to discuss the phenomenon only in terms of distances between donor and acceptor chromophores in bichromophoric molecules. Our use of rigid bridged polycyclic compounds as frameworks upon which to place light-accepting chromophores and reaction sites enabled us to construct molecules in which initial tests of geometric, stereochemical and regio-chemical requirements for electron transfer, as well as other dimensional requirements, have been made. Thus we have shown that intramolecular electron transfer is controlled not only by thermodynamic features, but also by orbital features and geometry. We have looked at changes in substituents on aromatic light-absorbing chromophores and at abilities of excited electrons to be transferred to remote sites, compared with other modes of decay, depending upon the abilities of those sites to suffer reduction.

11469 Reactions of uranium hexafluoride photolysis products. Lyman, J.L.; Laguna, G.; Greiner, N.R. (Los Alamos National Laboratory Los Alamos, New Mexico 87545). *Journal of Chemical Physics;* **82**: No. 1, 175-182(1 Jan 1985).

This paper confirms that the ultraviolet photolysis reactions of UF_6 in the B band spectral region is simple bond cleavage to UF_5 and F. The photolysis products may either recombine to UF_6 or the UF_5 may dimerize, and ultimately polymerize, to solid UF_5 particles. We use four methods to set an upper limit for the rate constant for recombination of k/sub r/<2.0 x 10^{-12} cm^3 $molecule^{-1}$ s^{-1}. We measure the rate constant for UF_5 dimerization to be k/sub d/ = (1.0 +- 0.2) x 10^{-11} cm^3 $molecule^{-1}$ s^{-1}. The principal method employed in these studies is the use of diode lasers to monitor, in real time, the changes in density of the species UF_6 and UF_5 after laser photolysis of the UF_6 gas sample.

11470 Reactions of methyl and ethyl radicals with uranium hexafluoride. Lyman, J.L.; Laguna, G. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Chemical Physics;* **82**: No. 1, 183-187(1 Jan 1985).

We have measured the rates of reaction of both methyl and ethyl radicals with uranium hexafluoride (UF_6) in the gas phase. The method we used was to photolyze samples of UF_6 in the presence of either methane or ethane. The radicals produced by reaction of fluorine atoms with these species then react with either themselves or with UF_6. We inferred the rate constants from ratios of the reaction products and the published rate constants for radical recombination. The diagnostic technique was gas chromatography. The resulting rate constants for reaction with UF_6 were (1.6 +- 0.8) x 10^{-14} cm^3 $molecule^{-1}$ s^{-1} for methyl radicals and (4 +- 2) x 10^{-11} cm^3 $molecule^{-1}$ s^{-1} for ethyl radicals.

11471 Conversion of allylphosphine to novel diphosphines: synthesis and characterization of CH_2*h*$CHCH_2P(H)(CH_2)_3PH_2$ and $P[(CH_2)_3]^3P$. Diel, B.N.; Norman, A.D. (Univ. of Colorado, Boulder). *Phosphorus and Sulfur and the Related Elements;* **12**: 227-235(1982).

Irradiation (λ = 300-600 nm) of gaseous $CH_2{=}CHCH_2PH_2$ in a hot-cold reactor yields the new diphosphine, $CH_2{=}CHCH_2P(H)(CH_2)_3PH_2$(I). I results from the intermolecular head-to-tail addition of phosphine PH bonds to the C=C bonds of $CH_2{=}CHCH_2PH_2$, in an anti-Markovnikov process. The AIBN-[azo>2,2'-bis(isobutyronitrile)] initiated radical reaction of $CH_2{=}CHCH_2PH_2$ in benzene yields PH_3 and the novel bicycle diphosphine, $P[(CH_2)_3]_3P$(II). Characterization of I and II, based on ^{31}P, ^{1}H, and ^{13}C NMR and mass spectral data, is described.

4006 Radiation Chemistry

11472 Stochastic treatment of fast chemical reactions. Zaider, M.; Brenner, D.J. (Columbia Univ., New York, NY). *Radiation Research;* **100**: No. 2, 245-256(Nov 1984). Contract AC02-78EV04733.

A Monte Carlo code was developed to simulate stochastically the fast reactions of radiolysis products in water. The results of these calculations show that treatments based on deterministic kinetic rate equations do not reproduce correctly the evolution in time of the number of species. Ad hoc initial distributions of species in spurs, of the type used in deterministic approaches, are compared with more realistic distributions obtained from Monte Carlo-generated particle tracks. The effects of using either type of distribution, stochastically or deterministically, are discussed.

4007 Radiochemistry And Nuclear Chemistry

REFER ALSO TO CITATION(S) 40070010957

11473 (CONF-841210—3) Frontiers of chemistry for americium and curium. Keller, O.L. Jr. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 11p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85004413.

From International chemical congress of Pacific Basin Societies; Honolulu, HI, USA (16 Dec 1984).

The discoveries of americium and curium were made only after Seaborg had formulated his actinide concept in order to design the chemistry needed to separate them from irradiated ^{239}Pu targets. Their discoveries thus furnished the first clear-cut evidence that the series exists and justified Seaborg's bold assumption that even though Th and Pa appeared to presage a following 6d series, the pattern established by the periodic table after Cs and Ba would be repeated exactly after Fr and Ra. That is to say, a new 5f element rare earth series (the actinides) would follow Ac in the same way the 4f rare earth series (the lanthanides) follows La. The consequences of the resulting half-filled $5f^7$ shell at Cm were originally presented by Seaborg as a test of his hypothesis. Recent research is outlined that substantiates Seaborg's predictions in new and definitive ways. 15 references, 4 figures.

11474 Electrodeposition of Neptunium(V) films on noble metal electrodes. Maya, L. (Oak Ridge National Lab., TN). *Radiochimica Acta;* **34**: 131-133(1983). Contract W-7405-ENG-26.

The nature of neptunium films on noble metals electrodeposited in the course of the electrochemical reduction of Np (VI) solutions containing carbonate was studied. These films are tenaciously held on the electrodes. Raman spectroscopy and chemical evidence has led to the identification of the species present in the films as $NaNpO_2CO_3$ x nH_2O. 14 references, 1 figure.

4008 Combustion, Pyrolysis, And High-temperature Chemistry

11475 (DOE/ER/10505—4) Identification and temporal behavior of radical intermediates formed during the combustion and pyrolysis of gaseous fuels: kinetic pathways to soot formation. Progress report, September 1, 1982-June 30, 1985. Kern, R.D.; Singh, H.J.; Pamidimukkala, K.M.; Wu, C.H.; Esslinger, M.A.; Winkeler, P.W. (New Orleans Univ., LA (USA). Dept. of Chemistry). Jan 1985. Contract AS05-79ER10505. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85006173.

Many of the questions that we raised in our previous proposal about the mechanism by which several key fuels react in the preparticle soot formation process have been answered. Many new questions have been posed and these will be considered in the pro-

posal portion of our report. The first question that we addressed was the amount of soot formed as reported in the literature from the pyrolyses of toluene, benzene, butadiene, and acetylene. The first two fuels were reported to have maximum soot yields of 80 to 90% from a similar amount of initial carbon atom concentration; namely, 2 x 10^{17} atoms/cm^3. Additionally, it was believed that the major reaction pathway for aromatics was that of ring condensation which led directly to soot via PCAH formation as opposed to ring fragmentation producing acetylene as the major product which was followed by a polyacetylenic route to soot formation. This proposition was based upon the experimental observation that an equivalent amount of acetylene gave rise to much lower soot yields (~ 10%) than either toluene or benzene. The experimental technique employed was the laser extinction method coupled to a shock tube. 19 references.

11476 **(DOE/ER/13224—T1) Kinetic measurements on elementary fossil fuel combustion reactions over wide temperature ranges. Progress report, May 1, 1984-November 30, 1984.** Fontijn, A. (Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Chemical and Environmental Engineering). Dec 1984. Contract FG02-84ER13224. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85004934.

Most bimolecular elementary combustion reactions, when observed over wide temperature ranges, show non-Arrhenius behavior. This makes extrapolation from low temperature rate coefficient data uncertain. Currently available reliable data have commonly been obtained near room temperature. A larger high temperature data base is needed to improve understanding of the change in rate coefficients with temperature and to provide meaningful input data and predictions for combustion modellers. In the current work the kinetics of isolated elementary fossil fuel combustion reactions are investigated. Experiments are performed in the HTP (high-temperature photochemistry) reactor, suitable for measurements over the 300 to 1800°K range. Emphasis is placed on data above 1000°K. The current object of study is the O + C_2H_4 reaction. 14 references. 1 figure.

42 ENGINEERING

11477 **(UCID—20297-84-4) Granular flow project. Quarterly report, October-December 1984.** Walton, O.R. (ed.). (Lawrence Livermore National Lab., CA (USA)). 20 Dec 1984. Contract W-7405-ENG-48. 21p. NTIS, PC A02MF A01; 1; GPO Dep. File Number DE85005479.

The major effect of LLNL's Granular Flow Project during FY85 is the development of new three-dimensional discrete particle computer models for simulating the flow behavior of granular solids. In these models the kinematics of interactions between inelastic, frictional spheres is calculated directly from the application of interaction forces to each particle. The behavior of the bulk material is obtained by averaging over both space and time the forces, velocities, and positions of the particles in the assembly. The bulk behavior calculated by such discrete particle computer simulation depends ultimately on the validity of the interparticulate force models employed and on the accuracy with which the effects of these forces are modeled. During the first quarter of FY85 our efforts have concentrated on: (1) testing the recently developed force models against experimental data and theoretical analyses and, (2) testing our new 2-dimensional steady state shearing model against similar molecular-dynamics computer models to make sure that the numerical methods and averaging techniques are working correctly. We report below the results of these two efforts. 6 references, 10 figures.

4201 General Engineering

11478 **(SAND—84-2304C) Mechanisms of dynamic fragmentation: factors governing fragment size.** Grady, D.E.; Kipp, M.E. (Sandia National Labs., Albuquerque, NM (USA)). 1984. Contract AC04-76DP00789. 22p. (CONF-8411109—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004460.

From Workshop on inelastic deformation and failure modes; Evanston, IL, USA (18 Nov 1984).

The fragment size produced in the dynamic fragmentation process is the central issue of this study. Theoretical developments based independently on inherent fracture-producing flaw concepts and on energy balance concepts have been reported previously. These theories are examined and tested on several applications, including oil shale fragmentation, dynamic fragmentation of expanding metal shells and rings, dynamic liquid fragmentation, and propellant fracturing of drill holes in rock. A description of dynamic fragmentation is proposed which reconciles the need for both fracture flaw and energy balance concepts. Preliminary computational studies of dynamic fracture and fragmentation are described which illustrate the relative importance and range of influence of fracture flaw and energy balance effects.

11479 **(UCID—30200-83-2) BEARING and BPLOT: two programs for designing full (360-degree) journal bearings.** Pierce, R.E. (Lawrence Livermore National Lab., CA (USA)). 7 Sep 1984. Contract W-7405-ENG-48. 42p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85005553.

Computer programs BEARING and BPLOT can be employed to design full (360-degree) hydrodynamic journal bearings. They use a computerized approach to most of Chapter 10 of Mechanical Engineering Design, by J. E. Shigley. The only difference between BEARING and BPLOT is that BPLOT has a graphics feature that allows the designer to visually compare a design with previously established criteria of good design practice.

4202 Facilities And Equipment

REFER ALSO TO CITATION(S) 42020010963, 10966, 10985, 11108

11480 **(AD-A—142076) Evaluation and demonstration of the viability of salt bath solution heat treatment for D.U. penetrators. Final report.** Muller, J.F.; Nead, R.L. (Aerojet Ordnance Co., Jonesboro, TN (USA)). Mar 1984. 38p. US Army Armament Research and Development Center, Dover, NJ. File Number TI85900221.

An MM & T program to evaluate and demonstrate the viability of a salt bath solutionizing heat treatment for large caliber DU penetrators (0.75% by weight titanium) was conducted. One hundred M774 core blanks were evaluated to develop and verify the various process stages (e.g., outgassing salt residence times, etc.) of salt heat treatment. A viable salt bath heat treatment process was developed through this program. A pilot lot of 40 finished machined M774 penetrators was fabricated under the guidelines of this program and is available for ballistic testing. Included in this report is a general analysis of facility requirements to implement salt solutionizing heat treatment into the Aerojet production stream.

11481 **(BNL—35374) Optimization of Nb_3Sn.** Suenaga, M. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 7p. (CONF-840937—27). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005121.

From Applied superconductivity conference; San Diego, CA, USA (9 Sep 1984).

Considerable progress has been made in the fabrication of large quantities of Nb_3Sn multifilamentary wires, and a number of small and large magnets have been produced successfully using these wires. However, demands for increased critical-current densities J/sub c/ in the medium magnetic field range (8 to 12 T) as well as at very high fields (16 to 20 T or greater) are now being made in order to reduce the cost and to increase the efficiencies of large machines (fusion reactors and high-energy particle accelerators). In order to help meet these demands, some improvements have recently been made in increasing J/sub c/ of Nb_3Sn, e.g., Ti additions to Nb_3Sn. In this presentation, the characterization of Nb_3Sn for physical properties (resistivity, lattice parameter, chemical compositions at the grain boundaries and in the bulk, etc.) and for microstructural and chemical properties will be reviewed and those properties which are particularly important in producing high values of J/sub c/ will be discussed.

11482 **(CONF-830609—74) Criticality safety training at the Hot Fuel Examination Facility.** Garcia, A.S.; Courtney, J.C.; Thelen, V.N. (Argonne National Lab., Idaho Falls, ID (USA)). 1983. Contract W-31-109-ENG-38. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005018.

From ANS annual meeting; Detroit, MI, USA (12 Jun 1983).

HFEF comprises four hot cells and out-of-cell support facilities for the US breeder program. The HFEF criticality safety program includes training in the basic theory of criticality and in specific criticality hazard control rules that apply to HFEF. A professional staff-member oversees the implementation of the criticality prevention program. (DLC)

11483 **(DOE/ER/12054—T1) Computerized underground image reconstruction. Progress report, July 15, 1982-April 15, 1983.** Dines, K.A. (XDATA Corp., Indianapolis, IN (USA)). Apr 1983. Contract AC02-82ER12054. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005406.

Work-in-progress is described on the development of computer-aided geophysical tomography. Software has been developed and implemented for a field-deployable, microcomputer-based tomographic imaging system. The field system provides the ability to reconstruct two-dimensional images of electromagnetic attenuation in the region between two boreholes. Research on iterative resolution methods for treating the non-uniqueness problem in geophysical tomography is also discussed.

11484 **(K/P—6816) Cooling tower wood sampling analyses: a case study.** Haymore, J.L. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Sep 1984. Contract AC05-84OT21400. 22p. (CONF-850138—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004173.

From Cooling Tower Institute meeting; New Orleans, LA, USA (21 Jan 1985).

Extensive wood sampling and analyses programs were initiated on crossflow and counterflow cooling towers that have been in service since 1951 and 1955, respectively. Wood samples were taken from all areas of the towers and were subjected to biological, chemical and physical tests. The tests and results for the analyses are discussed. The results indicate the degree of wood deterioration, and areas of the towers which experience the most advanced degree of degradation. 6 references, 3 figures, 6 tables.

11485 **(LA—10231-SOP) Standard operating procedure, gas atmosphere brazing facility/LAMPF Equipment Test Laboratory.** Suazo, G.; Koczan, S.P. (Los Alamos National Lab., NM (USA)). Oct 1984. Contract W-7405-ENG-36. 56p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85005316.

A hydrogen and argon gas atmosphere furnace facility using electric furnaces is located at the Clinton P. Anderson Meson Physics Facility (LAMPF). These industrial furnace systems were specifically purchased for use in assembling the LAMPF linear accelerator by means of hydrogen gas furnace brazing. The furnace facility continues to meet the need for the brazing of accelerator replacement components, klystron tube rebuilding, and support of experiment needs for special apparatus best assembled by atmosphere furnace brazing techniques. The detailed operation sequence and description of this furnace facility are covered by this report.

11486 **(ORNL/TM—7179/R1) Oak Ridge National Laboratory shipping containers for radioactive materials.** Schaich, R.W. (Oak Ridge National Lab., TN (USA)). Sep 1984. Contract AC05-84OR21400. 246p. NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE85004772.

The following types of ORNL containers are described: Type A packages; Type B packages; commercial packages; and special form containers.

11487 **(PB—84-217884) Coaxial noise standard for the 1 GHz to 12.4 GHz frequency range. Final report.** Daywitt, W.C. (National Bureau of Standards, Boulder, CO (USA). Electromagnetic Fields Div.). Mar 1984. 48p. (NBS/TN—1074). NTIS, PC A03/MF A01.

Also available from Supt. of Docs as SN003-003-02564-0.

This note describes the design and construction of a coaxial thermal noise standard. The standard is designed to operate at the boiling point of liquid nitrogen with a noise temperature accurate to + or - 1 K in the frequency range from 1 GHz to 12.4 GHz.

11488 **(UCID—20283) Field measurement of tension in a T-142 tank track.** Trusty, R.M.; Wilt, M.D.; Carter, G.W.; Lesuer, D.R. (Lawrence Livermore National Lab., CA (USA)). 1 Nov 1984. Contract W-7405-ENG-48. 17p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005300.

This paper describes a method employed by the Engineering Measurements Section at the Lawrence Livermore National Laboratory (LLNL) to measure the tension developed between neighboring track sections of a T-142-track mounted on an M-60 tank at the Yuma Proving Grounds. Such information is important for input to the computer models that are being developed by the laboratory for the US Army Tank-Automotive Command. A section of track was instrumented with strain gages and mounted in a tensile testing machine. The strain gage output was then calibrated as a function of tension. The calibrated track section was mounted on the tank and connected through a hard-wire electrical tether to a portable data acquisition system. A video recording system with a clock common to the data acquisition system was used to correlate environmental inputs to tension data. Initial track pre-tension levles were measured. Data were also acquired when the tank traversed several objects, moved uphill over an obstacle, and executed pivot turns. This data have been used in the new computer models at LLNL.

11489 **Locking mechanism for indexing device.** Lindemeyer, C.W. (to Dept. of Energy). US Patent 4,464,948. 14 Aug 1984. Filed date 25 Jan 1982. vp.

Disclosed is a locking mechanism for an indexing spindle. A conventional spur gear having outwardly extending teeth is affixed to the spindle. Also included is a rotatably mounted camshaft whose axis is arranged in skewed relationship with the axis of the spindle. A disk-like wedge having opposing camming surfaces is eccentrically mounted on the camshaft. As the camshaft is rotated, the camming surfaces of the disc-like member are interposed between adjacent gear teeth with a wiping action that wedges the disc-like member between the gear teeth. A zero backlash engagement between disc-like member and gear results, with the engagement having a high mechanical advantage so as to effectively lock the spindle against bidirectional rotation.

11490 **Report on Stanford superconductive monopole detectors.** Cabrera, B.; Bourg, J.; Gardner, R.; Huber, M.; Taber, M. (Stanford Univ., Stanford, CA). pp 439-449 of Monopole '83. Stone, J.L. New York, NY, USA; Plenum Press (1984). (CONF-8310227—).

From Monopole '83 conference; Ann Arbor, MI, USA (6 Oct 1983).

This chapter presents the most recent results from the operation of a three loop superconducting detector with a signal to noise ratio of 100 for the direct detection of Dirac magnetic charges. Plans to build a larger fixed loop detector with a sensing area of 1.5 m^2 are discussed. Topics considered include theoretical and astrophysical considerations, a new large twisted loop detector, and a future 100 m^2 superconductive detector array. It is concluded that it is now possible to search down to the Parker flux bound using definitive superconductive detectors.

11491 **Zero-quantum superconducting magnetic shield.** Clem, J.R. (Ames Lab., USDOE Iowa State Univ., Ames, IA). pp 481-490 of Monopole '83. Stone, J.L. New York, NY, USA; Plenum Press (1984). (CONF-8310227—).

From Monopole '83 conference; Ann Arbor, MI, USA (6 Oct 1983).

The design of a new superconducting magnetic shield suitable for use with magnetic monopole detectors is described, together with a method for achieving a final state in which no magnetic flux quanta are trapped in the shield's central region. The magnetic shield consists basically of a specially designed superconducting cylindrical tube, equipped with electrical and magnetic devices to remove flux quanta trapped during cooldown. An electrical current is applied along the length of the tube to cause mutual annihilation of trapped vortices and antivortices in the tube's central region and

thus to remove flux quanta transverse to the cylinder axis. A parallel applied magnetic field then moves an appropriate number of vortices and antivortices from tube-end reservoirs to opposite ends until no longitudinal flux quanta thread the tube. Also, a procedure is described by which the shield itself could be used as a monopole detector.

11492 **Ductile fracture of rapidly expanding rings.** Johnson, J.N. (Los Alamos National Lab., NM). *Journal of Applied Mechanics;* **105**: 593-600(Sep 1983).

Heterogeneous plastic deformation (necking) of thin ductile rings given an initial outward impulse is described in terms of the ordinary differential equations of thermoplasticity and the partial differential equations of mass and momentum conservation in one spatial dimension (circumference) and time. Flaws in cross sectional area and porosity are introduced and the resulting plastic deformation is calculated numerically for a prescribed initial radial velocity. Plastic deformation is initially homogeneous but soon concentrates in the weakest region, which then thins rapidly and fractures. Effects of flaw wavelength, work-hardening rate, thermal softening, and rate-dependent plastic flow on the flaw growth rate are studied.

4203 Lasers

11493 **(AD-A—143216/0) Compact frequency-stable pulsed CO_2 laser.** Jordon, D.L.; Hollins, R.C. (Royal Signals and Radar Establishment, Malvern (UK)). 1984. 15p. (RSRE-MEMO—3670). NTIS, PC A02/MF A01.

The aim of this memorandum is to outline the results of work carried out at RSRE to develop a compact frequency-stable CO_2 laser. This work has resulted in the production of a simple, highly compact device (165 x 80 x 50 mm) having a 1.5 MW, 35 ns output pulse which is both inter and intra-pulse frequency-stable to within 3 MHz.

11494 **(AD-A—143295/4) Visible and near-infrared dissociation lasers. Final report 21 January 1982-20 April 1984.** Eden, J.G. (Illinois Univ., Urbana (USA). Dept. of Electrical Engineering). Jul 1984. 18p. (UILU-ENG—84-2548). NTIS, PC A02/MF A01.

Experiments have been conducted in which a tunable, injection-locked cadmium monoiodide (CdI) laser has been demonstrated. Over a 50 A spectral region centered at 657 nm, complete locking of the slave amplifier occurs for injected laser intensities of 5 W - cm-2. Also, an electron beam pumped I_2 green excimer amplifier at 506 nm has been developed. Coupling between the UV and green bands of I_2 has been shown to be strong and the small signal gain coefficient at 506 nm is $>$ 5% - cm-1.

11495 **(AD-A—143449/7) Measurement of the transverse mode excitation in the stimulated emission of the ACO free electron laser. Final report 15 September-31 December 1983.** Deacon, D.A.G. (Deacon Research, Sunnyvale, CA (USA)). 30 Mar 1984. 61p. (DR—3). NTIS, PC A04/MF A01.

Measurements of the off-diagonal terms in the transverse gain matrix of the free electron laser were obtained and analyzed under this contract. Quantitative agreement was demonstrated with the low-diffraction theory. The scaling was demonstrated as a function of anlaysis distance, electron beam size, and resonance parameter. The effects of multiple mode input were observed, and a general analytic expression derived for this regime.

11496 **(AD-A—143538/7) Laser physics and laser techniques. Final technical report 1 February 1982-31 January 1984.** Siegman, A.E. (Stanford Univ., CA (USA). Edward L. Ginzton Lab.). Apr 1984. 43p. (GL—3712). NTIS, PC A03/MF A01.

This report summarizes research, journal publications, and conference presentations in the areas of picosecond optical pulses and picosecond spectroscopy; laser-induced surface transformations and spontaneous 'ripples'; tunable-laser-induced-grating spectroscopy; and optical phase conjugation and phase-conjugate resonators.

11497 **(MLM—3213) Low jitter trigger for an excimer laser.** Kershner, C.J.; Burgess, E.T.; Faklis, D. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 11 Dec 1984. Contract AC04-76DP00053. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005732.

The use of a highly focused beam from a small Q-switched Nd-YAG laser to trigger the high-voltage spark gap switch of a rare gas excimer laser is described. The design not only results in an order of magnitude improvement in jitter, but also leads to greatly improved trigger reliability and less electromagnetic interference to electronic equipment in the vicinity of the operating excimer laser.

11498 **Exploding foil technique for achieving a soft x-ray laser.** Rosen, M.D.; Hagelstein, P.L.; Matthews, D.L.; Campbell, E.M.; Hazi, A.U.; Whitten, B.L.; MacGowan, B.; Turner, R.E.; Lee, R.W.; Charatis, G.; Busch, G.E.; Shepard, C.L.; Rocket, P.D. (University of California, Lawrence Livermore National Laboratory, Livermore, California 94550). *Physical Review Letters;* **54**: No. 2, 106-109(14 Jan 1985). Contract W-7405-ENG-48.

We describe a design for producing a soft x-ray laser via 3p-3s transitions in Ne-like selenium (wavelength of about 200 A). A 0.53-μm laser, focused in a 1.2 x 0.02 cm spot to 5 x 10^{13} W/cm^2, heats and burns through a thin foil of Se. Besides ionizing the Se to a Ne-like state, the laser explodes the foil, creating a region of uniform electron density. This allows propagation of the x rays down the 1-cm-long gain direction without debilitating refraction. Gains of 4 to 10 cm^{-1} are predicted for various transitions.

11499 **Demonstration of a soft x-ray amplifier.** Matthews, D.L.; Hagelstein, P.L.; Rosen, M.D.; Eckart, M.J.; Ceglio, N.M.; Hazi, A.U.; Medecki, H.; MacGowan, B.J.; Trebes, J.E.; Whitten, B.L.; Campbell, E.M.; Hatcher, C.W.; Hawryluk, A.M.; Kauffman, R.L.; Pleasance, L.D.; Rambach, G.; Scofield, J.H.; Stone, G.; Weaver, T.A. (University of California, Lawrence Livermore National Laboratory, Livermore, California 94550). *Physical Review Letters;* **54**: No. 2, 110-113(14 Jan 1985). Contract W-7405-ENG-48.

We report observations of amplified spontaneous emission at soft x-ray wavelengths. An optical laser ionized thin foils of selenium to produce a population inversion of the 2p ^{5}3p and 2p ^{5}3s levels of the neonlike ion. Using three time-resolved, spectroscopic measurements we demostrated gain-length products up to 6.5 and gain coefficients of 5.5 +- 1.0 cm^{-1} for the J = 2 to 1 lines at 206.3 and 209.6 A. We also observed considerable amplification for the same transitions in yttrium at 155.0 and 157.1 A.

11500 **Synchrotron-betatron resonances in free-electron lasers.** Fawley, W.M.; Prosnitz, D.; Scharlemann, E.T. (Lawrence Livermore National Laboratory, University of California, P.O. Box 808, Livermore, California 94550). *Physical Review [Section] A: General Physics;* **30**: No. 5, 2472-2481(Nov 1984). Contract W-7405-ENG-48.

The coupling between betatron and synchrotron oscillations in a tapered wiggler free-electron laser (FEL) is investigated analytically and numerically. The resonance between the oscillations, first investigated by Rosenbluth, is shown to be important only for a very limited range of parameters. In general, the resonance is not a serious detrapping mechanism for high-power FEL amplifiers.

11501 **Research and development of laser glasses in China.** Gan Fuxi. (Shanghai Institute of Optics and Fine Mechanics, Academia Sinica). *Zhongguo Jiguang;* **11**: No. 8, 449-459(Aug 1984). (In Chinese).

Most of the research on laser glasses in China is carried out at Shanghai Institute of Optics and Fine Mechanics, and significant achievements have been made since 1962. A review of the current status of development of laser glass is presented, including chemical compositions and physical properties, manufacturing technology, measurement and inspection and some fundamental research.

11502 **Optical pumping in a whispering mode optical waveguide.** Kurnit, N.A. (to Dept. of Energy). US Patent 4,439,260. 27 Mar 1984. Filed date 11 Aug 1981. vp.

A device and method for optical pumping in a whispering mode optical waveguide. Both a helical ribbon and cylinder are disclosed which incorporate an additional curvature for confining the beam to increase intensity. An optical pumping medium is disposed in the optical path of the beam as it propagates along the waveguide. Optical pumping is enhanced by the high intensities of the beam and long interaction pathlengths which are achieved in a small volume.

11503 **Theory of generalized adiabatic following in multilevel systems.** Hioe, F.T. (St. John Fisher Coll., Rochester, NY). *Physics Letters;* **99A**: No. 4, 150-155(28 Nov 1983). Contract AC02-82ER13012.

An exact analytic result in the theory of multiple laser excitation of multilevel atoms by multiphoton adiabatic following is presented.

11504 **(UCRL-Trans—12011) Nonlinear wavelength conversion techniques for laser light harmonic generation by new nonlinear optical crystals.** Kato, K. Translated from *Opo Butsuri ;* **52**: No. 8, vp(1983). Contract W-7405-ENG-48. 9p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85000344. DE85000344

The author has presented a detailed discussion in Japanese concerning high-efficiency harmonic generation in Nd:YAG lasers, which have high peak and average outputs. In the past two or three years, however, there has been remarkable progress in the development of variable wavelength lasers which use an Nd:YAG laser as the basic light source. In the infrared region above a wavelength of 5 μm, the idler of a $KNbO_3$ parametric oscillator and the fundamental wave of an Nd:YAG laser have been mixed using $AgGaS_2$, so that it has become easy to achieve difference frequency generation with a peak output rate of 100 kW (~ 1 mJ) down to 12 μm. In the case of sum frequency generation with the fourth harmonic using urea, it has become possible to obtain variable wavelength ultraviolet light reaching 7MW (50 mJ) at 2196 A. In this paper, the author will discuss high efficiency high output wavelength conversion to shorter wavelengths using new crystals (the discussion is based on experimental data obtained by the author).

11505 **Reinjection laser oscillator and method.** McLellan, E.J. (to Dept. of Energy). US Patent 4,468,776. 28 Aug 1981. Filed date 20 Aug 1981. vp.

A uv CO_2 oscillator with integral four-pass amplifier capable of providing 1 to 5 GW laser pulses with pulse widths from 0.1 to 0.5 ns full width at half-maximum (FWHM) is descrribed. The apparatus is operated at any pressure from 1 atm to 10 atm without the necessity of complex high voltage electronics. The reinjection technique employed gives rise to a compact, eficient system that is particularly immune to alignment instabilities with a minimal amount of hardware and complexity.

4204 Heat Transfer And Fluid Flow

REFER ALSO TO CITATION(S) 42040011146

11506 **(CONF-830803—11) Three-dimensional lid-driven cavity flow: experiment and simulation.** Koseff, J.R.; Street, R.L.; Gresho, P.M.; Upson, C.D.; Humphrey, J.A.C.; To, W.M. (Stanford Univ., CA (USA). Dept. of Civil Engineering; Lawrence Livermore National Lab., CA (USA); California Univ., Berkeley (USA). Dept. of Mechanical Engineering). 1983. Contract AT03-81ER10867. 18p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004437.

From 3. international conference on numerical methods in laminar and turbulent flow; Seattle, WA, USA (8 Aug 1983).

A facility has been constructed to study shear-driven, recirculating flow, namely, a three-dimensional lid-driven cavity flow. In the extant case, the cavity depth-to-width aspect ratio is 1:1, while the span-to-width aspect ratio is 3:1. A description of the circulation cell structure obtained by flow visualization is given for two Reynolds numbers with and without temperature-induced density stratification. The experimental results are compared to simulations by two different numerical codes, one employing finite differences and one employing finite elements. The numerical codes reproduce the overall behavior observed in the experiments, but fail to simulate observed longitudinal vortices. There are some significant differences also between the numerical results, highlighting the effects of using the HYBRID (upwind/central) differencing scheme in one code.

11507 **(CONF-850712—3) Mixing, chemical reaction and flow field development in ducted rockets.** Vanka, S.P.; Craig, R.R.; Stull, F.D. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004083.

From 21. AIAA/ASME/SAE joint propulsion conference; Monterey, CA, USA (8 Jul 1985).

The present study has been undertaken to analytically study the characteristics of the three-dimensional reacting flow field in ducted rocket configurations. In this study, equations governing the fully-elliptic three-dimensional reacting flow have been solved numerically by an iterative finite-difference algorithm. For simplicity, the combustion process is assumed to occur in a one-step fast chemical reaction, represented as 1 kg fuel + i kg oxidant = (1 + i) kg products, where i is the stoichiometric oxidant-to-fuel ratio. The chemical reaction is taken to be mixing-limited and fuel and oxidant are assumed to react instantaneously. The effects of turbulence are represented through a turbulence model in which a scalar eddy viscosity is calculated from two local turbulence variables. In the current work, the ($k \sim \epsilon$) turbulence model has been used and partial differential equations are solved for the transport of the kinetic energy of turbulence, k, and its dissipation rate, ϵ. Radiation is neglected. These simplifications have been made primarily to capture the important features of the flow without extensive computation. In the present work, calculations also have been made for different geometrical parameters to study their influence on flow field development and mixing efficiency. The paper will discuss the detailed three-dimensional flow fields, temperature contours and fuel distributions and the effects of various geometrical parameters.

11508 **(CONF-8308103—2) Mixing in a stratified recirculating flow.** Koseff, J.R.; Rhee, H.; Street, R.L. (Stanford Univ., CA (USA)). 1983. Contract AT03-81ER10867. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85003893.

From ASCE hydraulics division specialty conference; Cambridge, MA, USA (8 Aug 1983).

Experiments were conducted to study the mixing processes and circulation patterns in a stratified, lid-driven cavity flow. This flow is different from those reported in the literature in three ways, viz., recirculation is a dominant feature, temperature is used as the stratification device, and the upper and lower boundaries are held at different constant temperatures. For the geometric configuration used entrainment rate E is proportional to Ri/sup -7/5/. Taylor-Goertler-like vortices above the thermocline are significant contributors to the mixing process. In addition, the number of circulation cells expected in this stratified flow can be estimated by use of the bulk Richardson number Ri/sub b/.

11509 **(KFK—3739) Investigation of a natural convection in a small slot using a finite difference method.** Schira, P.; Guenther, C.; Mueller, U. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorbauelemente). Jul 1984. 75p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE85750304.

Experimental results by Koster who studied natural convection processes in slender Hele-Shaw cells are simulated with an existing two-dimensional natural convection code. This investigation yields the following results: The basic model of the calculations, which assumes a constant temperature across the gap (smallest extent of the Hele-Shaw cell) and thus without heat exchange with the Plexiglas windows, leads to an underestimation of the experimentally obtained critical Rayleigh numbers (onset of convection, onset of oscillatory convection) by one order of magnitude and an overestimation of the nondimensional period compared to experimental findings. Another version of the code, which permits heat exchange with the windows reveals an overestimation of the criti-

cal Rayleigh numbers and smaller dimensionless periods than the experiments. By these two different approaches, a two-side bounding of the Koster's experiments is achieved. As the modified version overestimates the real heat transfer from and to the windows, it may be concluded that using a suitably adapted heat transfer coefficient for the thermal coupling of the fluid and the windows numerical simulation would also reproduce quantitatively the results of Koster. The reason for the break down of the steady flow solution and the onset of transient flow was studied numerically by examining a model proposed by Howard. At this time no really satisfying answer to this question is available.

11510 **Two-phase flow: Models and methods.** Stewart, H.B.; Wendroff, B. (Applied Mathematics Department, Brookhaven National Laboratory, Upton, New York 11937). *Journal of Computational Physics;* **56**: No. 3, 363-409(Dec 1984).

A variety of two-phase flow models can be derived following few basic principles, which are here illustrated which no more generality than is essential. Among the models derived is one already widely used in applications, even though it is ill-posed in the sense of Hadamrd. Final assessment of such models remains a distant goal, but will clearly involve numerical solutions; several methods in current use are discussed with a guide to selecting the one appropriate to a particular problem.

11511 **Numerical solution of natural convection in eccentric annuli.** Pepper, D.W.; Cooper, R.E. (E.I. du Pont de Nemours & Co., Aiken, SC). *AIAA (American Institute of Aeronautics and Astronautics) Journal;* **21**: No. 9, 1331-1337(Sep 1983). Contract AC09-76SR00001.

From AIAA/ASME 3. joint thermophysics, fluids, plasma and heat transfer conference; St. Louis, MO, USA (7 Jun 1982).

The governing equations for transient natural convection in eccentric annular space are solved with two high-order accurate numerical algorithms. The equation set is transformed into bipolar coordinates and split into two one-dimensional equations: finite elements are used in the direction normal to the cylinder surfaces; the pseudospectral technique is used in the azimuthal direction. Transient solutions of the entire flowfield are obtained for $10^3 \leqq Ra \leqq 10^6$, $0.70 \leqq Pr \leqq 10^2$, with the inner cylinder near the top, bottom, and side of the outer cylinder. Results are similar to experimental and numerical values previously published for low Ra numbers.

11512 **Correlation of local heat flux from inclined volume-heated pools in bubbly flow.** Greene, G.A.; Jones, O.C. Jr.; Abuaf, N. (Brookhaven National Lab., Upton, NY). *American Society of Mechanical Engineers, [Paper];* No. 80-HT-91E, 1-7(1980).

Local and average heat transfer from volume-boiling pools in the two-phase bubbly flow regime to vertical and inclined flat boundaries were measured. The experimental technique and newly developed gold electroplated microthermocouples to make the measurements are described. A modification to the Boussinesq approximation for liquids is outlined which includes the effect of the average void fraction in a modified Rayleigh number. Heat transfer to vertical and inclined surfaces is correlated in a fashion similar to natural convection in the bubbly flow regime. The empirical correlation derived and their ranges of applicability are given.

4205 Materials Testing

11513 **(RFP—3548) Mechanically assembled non-bonded tranducers utilizing PVDF film.** Eoff, J.M. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 1983. Contract AC04-76DP03533. 17p. (CONF-830811—20). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004098.

From Conference on quantitative NDE; Santa Cruz, CA, USA (7 Aug 1983).

A high-resolution ultrasonic immersion transducer has been developed at the Rockwell Rocky Flats Transducer Laboratory. This model for a transducer enhances near surface flaw detection due to less front surface ring-out and better signal-to-noise ratios. Flaws less than the equivalent of .005-inch diameter flat bottom holes can be detected in most materials. Fabrication details and materials used in transducer construction will be explained. Comparison data showing the rf waveform, frequency spectrum, beam profile, and flaw dtection capabilities will be presented. Some additional benefits achieved from this transducer design are its relatively simple and inexpensive construction, the ability to change lenses or repair in the field, and its ruggedness to shock and handling damage.

11514 **Fitting curves to toughness data.** Oldfield, W. (Materials Research and Computer Simulation, Goleta, CA). *Journal of Testing and Evaluation;* **7**: No. 6, 326-333(Nov 1979).

Curve-fitting (regression) procedures for toughness data have been examined. Approaches using the normal probability function and the tanh function to model the transition between brittle and ductile behavior have been briefly reviewed. The objectives of fitting such curves have been summarized in the context of the study of nuclear pressure vessel steels as (1) convenient summarization of test data to permit comparison of materials testing methods; (2) development of statistical statements concerning the data, and (3) the study of changes in material behavior, particularly radiation damage. These objectives impose differing demands on the curves, which result in several versions of each approach. The computational and mathematical procedures that can be used with the tanh function have been described in detail, with examples of the different curves that can be fitted to the data. Six different algorithms to be used for situations involving different constraints have been summarized. Weighted regression has been reviewed briefly, with emphasis on the use of models to describe the changes in variance between the different modes of material behavior.

11515 **Curve fitting impact test data: a statistical procedure.** Oldfield, W. *ASTM Standardization News;* **3**: No. 11, 24-29(Nov 1975).

Quality assurance programs such as those related to nuclear pressure vessel materials usually require impact property measurements taken over a range of temperatures. These property measurements frequently include impact energy, fracture toughness, lateral expansion, or other quantities exhibiting the typical ductile-brittle transition. It is often difficult, however, to develop a suitable relationship between impact test data and temperature. Impact properties tend to vary in a sigmoidal fashion, starting at a fairly constant low value, increasing sharply over a short temperature range, and leveling off at a fairly constant higher value. The best approach to this task is through regression analysis. In this technique a mathematical model (usually a polynomial) is fitted to the test data so that the sum of squares of the deviations of the data points from the fitted curve is minimum. There are standard and relatively simple methods for fitting such equations which can handle transformations of the data before analysis. A curve fitting impact method is presented and discussed.

4208 Electronic Circuits And Devices

REFER ALSO TO CITATION(S) 42080011553

11516 **(AD-A—143233/5) Plasma switch development. Final report 26 February 1982-25 February 1984.** Commisso, R.J. (JAYCOR, Alexandria, VA (USA)). 8 Jun 1984. 184p. NTIS, PC A09/MF A01.

The work relates to two opening switch concepts that may be applied to inductive store/pulse compression techniques for various pulsed power applications. The opening switch concepts that are the subject of this final report are the electron-beam controlled switch and the plasma dynamic switch.

11517 **(LBL—18557) Fast readout of CCD images.** Turko, B.T. (Lawrence Berkeley Lab., CA (USA)). Oct 1984. Contract AC03-76SF00098. 8p. (CONF-841007—38). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004901.

From Nuclear science symposium; Orlando, FL, USA (31 Oct 1984).

A new fast serial readout system for CCD imaging devices is described. Clock frequency of up to 65 MHz and 1 μs line transfer time make possible frame rates of approximately 500/s. A baseline stabilized video amplifier and fast peak stretcher also make possible high resolution frame readout with excellent dynamic range. It uses a fast dump readout sequence which clears the analog registers prior to the image charge transfer from the photoelements. The charge of any preset pixel can be individually extracted, its peak stretched, and the noise distribution measured by a multichannel pulse-height analyzer. Photographs of test pattern readouts at high clock frequencies are shown and the effect of clock and frame readouts rates and temperature on noise distribution have been measured.

11518 **(NP—5900686) Qualification testing of photodiode, semiconductor, silicon 400-2931.** Hand, W.M. (Eastman Kodak Co., Rochester, NY (USA)). 28 Jun 1984. 166p. Eastman Kodak Co., 901 Elmgrove Rd., Rochester, NY 14650. File Number TI85900686.

Three photodiodes were subjected to mechanical shock, vibration, acceleration, temperature cycling, leak tests and 2000 hour dynamic life test at +40°C in accordance with Qualification Test Procedure QT-3036. Initial, interim, pre-life and final measurements were taken. All test samples visually survived the mechanical shock, vibration, acceleration and temperature cycling tests in accordance with Qualification Test Procedure QT-3036. All test samples failed fine leak testing when tested per paragraph 5.7.1 of QT-3036, Reference Test Data section. One test sample (S/N 7-10) and the control sample (S/N 5-18) were then subjected to gross leak testing per paragraph 5.7.2 of QT-3036. The control sample met the test requirements, but the test sample failed. Visual inspection of the test sample showed a crack along the epoxy seal. Visual inspection of the remaining two test samples (S/N 3-20 and 7-3) also revealed cracks along the epoxy seal. These two test samples were not subjected to gross leak testing to prevent possible damage due to FC-40 fluid seeping into the photodiodes. As a result of the hermeticity problem, photodiodes previously received were temperature screened. The package of the photodiodes remaining to be delivered was modified to improve hermeticity. The qualification test was continued to completion. The three test samples functioned nominally throughout the 2000 life test. In conclusion, the test samples acceptably survived qualification testing with the exception of hermeticity. Each photodiode received prior to the leak test failures were subjected to a temperature screen and visually examined for evidence of condensation within the package. The drawing was also modified to include a vent-hole in the package and the acceptance test procedure was changed to prohibit rework after a leak test failure.

11519 **(SAND—84-2022) High sheet resistance, arsenic implanted polycrystalline silicon for integrated circuit resistors.** Schubert, W.K. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1984. Contract AC04-76DP00789. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85004355.

The electrical properties of high sheet resistance polycrystalline silicon have been investigated to facilitate its use in fabricating integrated circuit resistors. The effects of ion implantation dose, energy and annealing procedures have been studied. Sheet resistances ranging from 10^3 to 10^9 Ω/square have been produced. A double depletion layer, thermionic emission model for electrical transport across grain boundaries accounts for many of the electrical properties, including the correlation of high activation energies with high sheet resistances. A reverse annealing peak in the sheet resistance is found for annealing temperatures between 800 and 1100°C. This irreversible effect is stronger in more lightly doped samples. The final sheet resistance value is primarily determined by the implantation dose and the highest processing temperature used. 37 references, 11 figures.

11520 **(SLAC-PUB—3511) FASTBUS software progress.** Gustavson, D.B. (Stanford Linear Accelerator Center, CA (USA)). Nov 1984. Contract AC03-76SF00515. 2p. (CONF-841007—41). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004677.

From Nuclear science symposium; Orlando, FL, USA (31 Oct 1984).

The FASTBUS Software Working Group has met several times since the 1983 Nuclear Science Symposium, including a meeting just preceding this conference. This paper summarizes the decisions taken and progress made, including the results of an ambitious summer program of experimentation with new ways of implementing the draft standard subroutines for FASTBUS.

11521 **(UCID—20214) Surface wave excitation study.** Burke, G.J.; King, R.J.; Miller, E.K. (Lawrence Livermore National Lab., CA (USA)). Sep 1984. Contract W-7405-ENG-48. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85005301.

Relative Communication Efficiency (RCE) as defined by Fenwick and Weeks was used for the results discussed here. RCE compares the field of a test antenna to that of a reference antenna at the same location for equal input power to each antenna. Thus, RCE is similar to power gain but is definable in the presence of ground. The main purpose of this study was to compare the effectiveness of antennas in launching TM surface waves. Antennas considered included the vertical dipole, monopole on a ground stake, monopole on a radial-wire ground screen, Beverage antenna and vertical half rhombic. Since the performance of these antennas is strongly dependent on parameters such as the number of wires in a ground screen or the length of a Beverage antenna, results are presented with parameters varying over a reasonable range. Thus, antenna performance can be weighed against the effort and limitations of construction.

11522 **Physics of VLSI.** Knights, J.C. (ed.). New York, NY; American Institute of Physics (1984). 310p. (CONF-8408104—). American Institute of Physics, 335 E. 45th Street, New York, NY 10017. File Number TI85002546.

From Conference on the physics of very large scale integration (VLSI); Palo Alto, CA, USA (1 Aug 1984).

The subject matter of the conference spanned a wide range of topics of current importance to VLSI including: Oxides and Insulators, Surfaces and Interfaces, Interconnections and Silicides, Lithography, Reactive Ion Etching, Defects in Semiconductors, Physics of Devices, Materials Processing, Materials Modelling, Design Automation and Device Layout, and III-V Compounds. 37 papers are included. (WHK)

4209 Waste Processing Plants And Equipment

REFER ALSO TO CITATION(S) 42090011008, 11009

11523 **(INIS-mf—8880) Dynamics and segregation of particles in a cyclone.** Mothes, H. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Chemieingenieurwesen). 12 Nov 1982. 145p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85780120.

In cyclone separator systems, the separation efficiency increases with increasing dust concentration, although the centripetal force, which is responsible for particle separation in a vortex, decreases with increasing particle concentration. This is demonstrated by laser-doppler-velocity-measurements. The measurements of separation efficiency together with the determination of particle size using stray radiation show that the effect of particle agglomeration is of major importance in the case of higher particle concentrations. Also smaller particles can be separated from the gas by agglomeration to larger particles, which can easily be separated. The calculations show that the improved separation at higher concentrations can be explained by this particle agglomeration effect. Finally different cyclone design models are discussed on the basis of the experimental results and the theoretical considerations on the particle dynamics in a cyclone.

4210 Combustion Systems

REFER ALSO TO CITATION(S) 42100011803

11524 (DOE/MC/19363—1713) Engineer, design, construct, test and evaluate a pressurized fluidized bed pilot plant using high sulfur coal for production of electric power. Phase III. Pilot plant construction. Final report. (Curtiss-Wright Corp., Wood-Ridge, NJ (USA). Power Systems Div.). Nov 1984. Contract FC21-82MC19363. 161p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85005329.

This final report describes the coal-fired plant design capable of producing electric power in an environmentally clean manner. The report presents the predicted performance using high sulfur bituminous coal and summarizes the construction activities and changes through completion on November 30, 1983. The construction activities involved: (1) the site excavation and pouring foundations for the PFB process equipment structural tower, control building, dolomite silo, boost compressor, and various equipment footings; (2) the fabrication and erection of the support steel work for the process equipment tower, control building, rail car thaw shed, and particulate scrubber and exhaust stack; (3) the fabrication and erection of the process equipment including the PFB combustor vessel, windbox, in-bed heat exchanger and process piping, the ash recycle system, the gas clean-up system, the ash removal, cooling and storage system, the coal handling, preparation and injection systems, the dolomite receiving, handling, storage and injection systems, the boost air compressor, dryer and receiver systems, the purge instrument and service air systems, the control, instrument and electrical systems, the tower elevator, the cardox, Halon and water fire protection system, etc. In addition, modifications and refurbishment were completed on the existing equipment at the site which was incorporated into the Pilot Plant system. Finally, plans were prepared describing the operating procedures, maintenance requirements, spare parts list, training program and manpower requirements for the proposed Phase IV test evaluation program. 37 figures, 11 tables.

11525 (DOE/MC/20334—T14) Study of deposition control using transpiration. Technical progress report. Louis, J.F.; Kozlu, H. (Massachusetts Inst. of Tech., Cambridge (USA)). Dec 1984. Contract AC21-83MC20334. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004794.

The purpose of this project is to determine the conditions in which transpiration may be used to avoid deposition of small particles. The application of this work is the control of the deposition of small particles over a surface kept at a temperature below the melting point of compounds likely to exist in the combustion products. A combined experimental and theoretical research program will be carried out to evaluate the concept of transpiration as a deposition control strategy. A first order theory will be refined by introducing an appropriate turbulence model. The experimental program is designed to evaluate and refine the theoretical model under conditions which provide the correct Reynolds and Stokes numbers. The experimental set up consists of a wind tunnel containing a flat porous transpired section. The measurements will determine the distribution of velocity and of particles concentration in the boundary layer. The experiments will be conducted with different particle sizes under conditions simulating gas turbine conditions.

11526 The state-of-the-art in understanding and solving flow induced vibration problems in shell-and-tube heat exchangers. Wambsgans, M.W. (Argonne National Laboratory, Argonne, IL). pp 38-39 of Shaping our energy future. Knoxville, TN, USA; LTM Consultants (1984). (CONF-840229—).

From 11. annual WATTec conference and exposition - shaping our energy future; Knoxville, TN, USA (21 Feb 1984).

Abstract only.

Shell-and-tube heat exchangers are used extensively in the process industries to exchange thermal energy. History shows that the industries have been plagued with heat exchanger tube vibration problems that have persisted over the years. In some cases, the resultant failures have been very costly with the actual cost of repairing the vibration-caused damage far overshadowed by the cost of the interrupted production and/or associated energy losses. Designing to avoid detrimental tube vibration represents one of the important and difficult problem areas facing designers; other problem areas of importance are flow distribution and fouling. In this paper, the dynamic behavior of an actual heat exchanger is reviewed. This is followed by a review of the three excitation mechanisms recognized to be responsible for tube vibration: turbulent buffeting, vortex shedding, and fluidelastic instability.

4240 Pollution Control Equipment

REFER ALSO TO CITATION(S) 42400010864, 10865, 10866, 10867, 11611

11527 (PB—84-224443) Recent advances in commercial organic-acid-enhanced FGD (flue gas desulfurization) systems. Report for September 1983-July 1984. Mobley, J.D.; Dickerman, J.C. (Environmental Protection Agency, Research Triangle Park, NC (USA). Industrial Environmental Research Lab.). Jul 1984. 19p. (EPA—600/D-84-195). NTIS, PC A02/MF A01.

Prepared in cooperation with Radian Corp., Research Triangle Park, NC.

The paper summarizes the results of several cost analyses that were performed to evaluate the potential economic benefits of converting operating flue gas desulfurization (FGD) systems to organic-acid-enhanced limestone scrubbing systems. In addition, it summarizes the first 2 years of operation of the first full-scale system to convert to organic-acid-enhanced operation--City Utilities' Southwest Power Plant. Application of organic-acid buffer enhancement to FGD systems is a recent development that has resulted in lowered costs and improved performance for systems that have adopted its use. A process that uses organic acids as an additive has several advantages over conventional limestone scrubber systems, including: improved SO2 removal, decreased limestone consumption, increased system flexibility (e.g., ability to respond to unplanned fluctuations in coal sulfur content), and improved process reliability.

43 PARTICLE ACCELERATORS

REFER ALSO TO CITATION(S) 43000011485

4301 Design, Development, And Operation

REFER ALSO TO CITATION(S) 43010011809

11528 (AD-A—143289/7) Pulsed power for race track induction accelerators. Schlitt, L.G.; Smith, I.D.; Bailey, V.L.; Birx, D.L.; Sears, R.G. (Pulse Sciences, Inc., San Leandro, CA (USA)). May 1984. 149p. NTIS, PC A07/MF A01.

The design of the baseline accelerator system excluding the injector and extractor appears relatively straightforward. Some development is needed particularly involving the insulation system for the vertical field coil, but no major technological advancements are necessary. The resulting system requires characterization of field errors and perturbations and of the match between vertical magnetic field and particle energy. Unfortunately it is not known whether the accelerating environment produced by the baseline design described above is consistent with stable beam acceleration. Synchronization of the vertical magnetic field with particle energy can be provided by a simple passive integration of the acceleration pulse in the baseline design.

11529 (ANL-HEP-CP—84-74) Super-collider: progress, options and physics. Diebold, R. (Argonne National Lab., IL (USA)). 18 Oct 1984. Contract W-31-109-ENG-38. 18p. (CONF-831277—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005026.

From 1. international conference on the physics of the 21st century; Tuscon, AZ, USA (5 Dec 1983).

The Superconducting Super Collider (SSC) has been given high priority by the high energy physics community. Various aspects of the project - physics motivation, accelerator design, siting considerations - are discussed here. The project is moving rapidly

and parts of this discussion have been updated to reflect the vast amount of work that has gone into the SSC since the conference.

11530 (CONF-8410172—5) Observations on the Munich MP arc discharge conditioning test. Ziegler, N.F.; Stelson, P.H.; Carli, W.; Muenzer, H.; Korschinek, G. (Oak Ridge National Lab., TN (USA); Beschleunigerlaboratorium der Univ. und Technischen Univ. Muenchen, Garching (Germany, F.R.); Technische Univ. Muenchen (Germany, F.R.)). 1984. Contract AC05-84OR21400. 3p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005372.

From Symposium of northeastern accelerator personnel; Stony Brook, NY, USA (15 Oct 1984).

The general consensus of the Munich accelerator staff was that the arc discharge had slightly improved Sections 3, 4, 5 and 6; Sections 7 and 8 were unchanged and Sections 1 and 2 were slightly poorer. This result was somewhat surprising in light of previous tests which demonstrated a marked improvement in breakdown voltage of short tube sections following an arc discharge cleaning. Also, Section 4 of the MP accelerator improved from 3.5 to 3.9 MV following a preliminary arc discharge cleaning test in December 1983.

11531 (GSF-P—277) Hitherto and future use of the accelerators of the PTA. Wittmaack, K.; Schulz, F. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.)). Feb 1984. 77p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE85750291.

In this report construction and power of the accelerators of the PTA are decribed, and the scientific work performed at these devices in the past years are summarizingly presented.

11532 (LBL—18298) Application of permanent magnets in accelerators and electron storage rings. Halbach, K. (Lawrence Berkeley Lab., CA (USA)). Sep 1984. Contract AC03-76SF00098. 24p. (CONF-841184—26). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004981.

From 30. annual conference on magnetism and magnetic materials; San Diego, CA, USA (27 Nov 1984).

After an explanation of the general circumstances in which the use of permanent magnets in accelerators is desirable, a number of specific magnets will be discussed. That discussion includes magnets needed for the operation of accelerators as well as magnets that are employed for the utilization of charged particle beams, such as the production of synchrotron radiation. 15 references, 8 figures.

11533 (LBL—18309) Experiments with heavy beams at the Berkeley Bevalac. Schroeder, L.S. (Lawrence Berkeley Lab., CA (USA)). Oct 1984. Contract AC03-76SF00098. 15p. (CONF-8406221—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85004898.

From 7. international seminar on high energy physics problems, multiquark interactions and quantum chromodynamics; Dubna, USSR (19 Jun 1984).

Some of the early results obtained with heavy beams (A greater than or $\simeq$ 100) at the Bevalac are presented. My intention is to give you a flavor of the research program that has developed in the early 1980's with the capability of accelerating nuclei spanning the full periodic table. 11 references, 8 figures.

11534 (SLAC-PUB—3509) Estimate of particle fluxes from the IR's at the SSC. Hwa, T.; Wojcicki, S.G. (Stanford Univ., CA (USA)). Nov 1984. Contract AC03-76SF00515. 3p. (CONF-8406198—37). NTIS, PC A02. File Number DE85005537.

From Design and utilization of the superconducting super collider summer study; Snowmass, CO, USA (23 Jun 1984).

There exists a considerable amount of interest in exploring the possibility of doing secondary beam physics at SSC. There are at least three obvious ways of obtaining secondary beams at the SSC, namely: (a) extraction of the primary stored beam and its subsequent targeting to generate secondary beams; (b) generation of secondary beams from internal target, either gas jet or thin wire or foil; and (c) utilization of particles produced in the primary collisions in the interaction regions. This note summarizes some calculations performed on the yields generated via the third mechanism. 2 references, 3 figures.

11535 Space-charge wave propagation in inhomogeneous waveguides. Anselmo, A.; Kerslick, G.; Nation, J.A.; Providakes, G. (Laboratory of Plasma Studies and School of Electrical Engineering, Cornell University, Ithaca, New York 14853). *Physics of Fluids;* **28**: No. 1, 358-365(Jan 1985).

In this paper, an account is presented of an investigation into the propagation of large amplitude space-charge waves in an inhomogeneous waveguide. The study is motivated by the possibility of using these waves for the collective acceleration of ions. Measurements are reported that show an increase in the wave phase velocity as the guide diameter, and hence the effective plasma frequency is decreased. Results are also presented which show that the wave phase velocity is a function of its amplitude, and that large amplitude, nonlinear waves propagate more slowly than those described by linear theory. The results demonstrate that it is possible to control the wave propagation characteristics, and therefore indicate the electron-beam-supported slow space-charge waves provide a suitable medium for collective ion acceleration. Finally, a summary is given of possible advantages of an electron beam-wave accelerator over those using externally generated rf fields.

4302 Beam Dynamics, Field Calculations, And Ion Optics

REFER ALSO TO CITATION(S) 43020011535

4303 Auxiliaries And Components

REFER ALSO TO CITATION(S) 43030011560, 11569, 11570, 11813, 11822, 11868, 11875

11536 (ANL/HEP-CP—84-81) Summary report: injection group. Simpson, J.; Ankenbrandt, C.; Brown, B.; Hojvat, C.; Johnson, R.; Marriner, J.; Ruggiero, A.; Treadwell, E.; Claus, J.; Cooper, J. (Argonne National Lab., IL (USA); Fermi National Accelerator Lab., Batavia, IL (USA); Brookhaven National Lab., Upton, NY (USA); Pennsylvania Univ., Philadelphia (USA); Los Alamos National Lab., NM (USA)). 1984. Contract W-31-109-ENG-38. 3p. (CONF-8406198—26). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005062.

From Design and utilization of the superconducting super collider summer study; Snowmass, CO, USA (23 Jun 1984).

The injector group attempted to define and address several problem areas related to the SSC injector as defined in the Reference Design Study (RDS). It also considered the topic of machine utilization, particularly the question of test beam requirements. Details of the work are given in individually contributed papers, but the general concerns and consensus of the group are presented within this note. The group recognized that the injector as outlined in the RDS was developed primarily for costing estimates. As such, it was not necessarily well optimized from the standpoint of insuring the required beam properties for the SSC. On the other hand, considering the extraordinary short time in which the RDS was prepared, it is an impressive document and a good basis from which to work. Because the documented SSC performance goals are ambitious, the group sought an injector solution which would more likely guarantee that SSC performance not be limited by its injectors. As will be seen, this leads to a somewhat different solution than that described in the RDS. Furthermore, it is the consensus of the group that the new, conservative approach represents only a modest cost increase of the overall project well worth the confidence gained and the risks avoided.

11537 (ANL-HEP-CP—84-86) pp Interaction Regions. Diebold, R.; Johnson, D.E. (Argonne National Lab., IL (USA); Fermi National Accelerator Lab., Batavia, IL (USA)). 1984. Contract W-31-109-ENG-38. 11p. (CONF-8406198—31). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004063.

From Design and utilization of the superconducting super collider summer study; Snowmass, CO, USA (23 Jun 1984).

This group served as the interface between experimenters and accelerator physicists. A start was made on a portfolio of IR's, building on previous studies including the Reference Designs Study (RDS). The group also looked at limits on time structure and luminosity, the clustering of IR's, external beams of secondary particles from the IR's, and various operational issues connected with the IR's. Designs were developed for interaction regions for RDS-B (individual cryostats for two 5-T rings, separated by 60 cm vertically). For a fixed geometry, the quadrupoles have been tuned over a range to give a factor of 100 variation in β^* (1 to 100 m) and thus in luminosity; an even larger variation may well be possible. Variation of the minimum β^* with free space between the quadrupole triplets, for a quad strength of 280 T/m and under the constraint of fixed chromaticity, showed a factor of five decrease in maximum luminosity in going from a high luminosity region with +-20 m free space to a small-angle region with +-100 m. Similar variants of the RDS-A IR were also found.

11538 (BNL—35311) Synchrotron radiation production and trapping of highly charged ions. Johnson, B.M.; Jones, K.W.; Meron, M. (Brookhaven National Lab., Upton, NY (USA)). Sep 1984. Contract AC02-76CH00016. 21p. (CONF-841117—30). NTIS, PC A02/MF A01; GPO Dep. File Number DE85004059.

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

Wiggler-enhanced synchrotron radiation will soon be available at dedicated facilities such as the National Synchrotron Light Source (NSLS) at Brookhaven National Laboratory. Two recent proposals to study highly-charged ions produced by successive photoionization with broad-band synchrotron radiation are based on the design parameters of the NSLS x-ray ring. Previous calculations indicated that in a suitable Kingdon trap, concentrations of 5 x 10^7 Ar^{18+} ions per cm can be attained in a few seconds trapping time and that in a Penning trap 5 x 10^3 Ar^{17+} ions could be stored at near thermal energies (300°K) to study, for example, charge transfer collision processes for cold, highly-charged ions. Here the previous work is reviewed and the earlier calculations are extended. The addition of an axial magnetic field to a Kingdon trap is shown to improve expected PHOBIS performance.

11539 (BNL—35486) Characteristics of synchrotron radiation. Thomlinson, W. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 10p. (CONF-8410112—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004189.

From Symposium on polymer research at synchrotron radiation sources; Upton, NY, USA (29 Oct 1984).

Synchrotron radiation is having a very significant impact on the many disciplines that make use of the radiation in the x-ray, vacuum ultraviolet, and infra-red regions of the spectrum. The rapidly increasing demand for beam time at existing facilities, the construction and commissioning of new facilities, and the world wide planning for future sources is clear testimony to the unique, interdisciplinary nature of the research applications. The nature of synchrotron radiation research continues to change and expand. This conference on the application of synchrotron radiation (SR) to polymer research illustrates that point. In this introductory paper it is impossible to cover in depth any of the applications. The intent, instead, is to give a brief, condensed summary of the properties of SR which have brought it to the fore as a research tool. No single source can provide the proper radiation for all applications. This paper should provide enough information and references to allow anyone contemplating a particular experiment to understand the widely varying parameters from different facilities, and thereby make some initial decisions concerning feasibility, and proper source. The NSLS will, in general, be used for illustration purposes since the conference is being held at Brookhaven where the attendees can get first hand familiarity with the facility.

11540 (BNL—35495) Breeding nuclear fuels with accelerators: replacement for breeder reactors. Grand, P.; Takahashi, H. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 20p. (CONF-841117—27). NTIS, PC A02/MF A01; GPO Dep. File Number DE85005131.

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

One application of high energy particle accelerators has been, and still is, the production of nuclear fuel for the nuclear energy industry; tantalizing because it would create a whole new industry. This approach to producing fissile from fertile material was first considered in the early 1950's in the context of the nuclear weapons program. A considerable development effort was expended before discovery of uranium ore in New Mexico put an end to the project. Later, US commitment to the Liquid Metal Fast Breeder Reactors (LMFBR) killed any further interest in pursuing accelerator breeder technology. Interest in the application of accelerators to breed nuclear fuels, and possibly burn nuclear wastes, revived in the late 1970's, when the LMFBR came under attack during the Carter administration. This period gave the opportunity to revisit the concept in view of the present state of the technology. This evaluation and the extensive calculational modeling of target designs that have been carried out are promising. In fact, a nuclear fuel cycle of Light Water Reactors and Accelerator Breeders is competitive to that of the LMFBR. At this time, however, the relative abundance of uranium reserves vs electricity demand and projected growth rate render this study purely academic. It will be for the next generation of accelerator builders to demonstate the competitiveness of this technology versus that of other nuclear fuel cycles, such as LMFBR's or Fusion Hybrid systems. 22 references, 1 figure, 5 tables.

11541 (CONF-841005—5) New focal plane detector system for the broad range spectrometer. Sjoreen, T.P. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 16p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005370.

From Instrumentation for heavy ion nuclear research conference; Oak Ridge, TN, USA (22 Oct 1984).

A focal plane detector system consisting of a vertical drift chamber, parallel plate avalanche counters, and an ionization chamber with segmented anodes has been installed in the Broad Range Spectrometer at the Holifield Facility at Oak Ridge. The system, which has been designed for use with light-heavy ions with energies ranging from 10 to 25 MeV/amu, has a position resolution of ~ 0.1 mm, a scattering angle resolution of ~ 3 mrad, and a mass resolution of ~ 1/60.

11542 (CONF-841117—33) Radiological safety at Argonne National Laboratory's heavy ion research facility. Cooke, R.H.; Wynveen, R.A. (Argonne National Lab., IL (USA)). 2 Nov 1984. Contract W-31-109-ENG-38. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005027.

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

This paper discusses the radiological safety system to be employed at the Argonne Tandem-LINAC Accelerator System (ATLAS). The design parameters of ATLAS that affect safety have remained unchanged since ATLAS construction began in 1982. The specialized radiological safety considerations of ATLAS were discussed in 1982. This paper will present the details of the hardware, the administrative controls, and the radiation monitoring that will be in effect when beam is produced in April 1985.

11543 (CONF-8403130—7) D0 Project at Fermilab. Marx, M.D. (State Univ. of New York, Stony Brook (USA)). 1984. Contract AC02-80ER10699. 21p. NTIS, PC A02. File Number DE85004962.

From 4. topical workshop on proton antiproton collider physics; Bern, Switzerland (5 Mar 1984).

The D0 Project will explore 2 TeV anti pp collisions at Fermilab using a highly optimized calorimetric detector, to elucidate the new physics coming out of the SppS, and to explore the new

higher energy regime. The design and physics potential of the detector system are described.

11544 **(DOE/ER/40025—27) Trigger drift chamber for the MKII upgrade at PEP.** Ford, W.T. (Colorado Univ., Boulder (USA)). Jun 1984. Contract AC02-81ER40025. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004873.

The design and fabrication work for the small trigger drift chamber are now advanced enough to permit a fairly detailed specification of this device as it will appear for installation in the detector next fall. This note contains a description of the trigger chamber design.

11545 **(DOE/ER/40146—1) Medium energy physics. Technical progress report.** (Syracuse Univ., NY (USA). Dept. of Physics). 1984. Contract FG02-84ER40146. 14p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85004886.

The major technical effort during the past year has been on the experiment at the MIT Bates Linear Electron Accelerator to measure the electroweak interference resulting when polarized electrons are scattered elastically from carbon. This effect is due to the possibility of exchanging the recently discovered intermediate vector boson, the Z^0, in addition to the usual one photon exchange. The design, installation, and testing of the polarized electron source are described, and testing and data analysis of the two quadrupole spectrometers are discussed. (WHK)

11546 **(DOE/SF/00515—T42) Stanford Linear Accelerator Center monthly report for November 1984.** (Stanford Linear Accelerator Center, CA (USA)). [1985]. Contract AC03-76SF00515. 20p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005437.

Operational activities for the month of November 1984 are reported in the areas of accelerator and research operations, research area and experiment status, accelerator improvements, research division developments, PEP division developments, and publications for the month. (GHT)

11547 **(GSI—84-42(Prepr.)) Intense beams of mass-separated, neutron-deficient indium, tin and lead isotopes.** Kirchner, R.; Marx, D.; Klepper, O.; Koslowsky, V.T.; Kuehl, T.; Larsson, P.O.; Roeckl, E.; Rykaczewski, K.; Schardt, D.; Eberz, J. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Jul 1984. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85750301.

A discharge ion source of the FEBIAD-type that delivers intense beams of neutron-deficient isotopes of indium, tin, thallium and lead produced in heavy-ion-induced fusion reactions is described. After mass separation the isotopically pure beams with intensities up to 3×10^7 ions/s were available for gamma and laser spectroscopy. This corresponds to an overall separation efficiency of about 30%.

11548 **(IS-T—1132) Particle detector performance in a Fermilab experiment.** Simpson, D.T. (Ames Lab., IA (USA)). 1 Aug 1984. Contract W-7405-ENG-82. 91p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85005503.

We examine the performance of a detector designed to study the high x region of the $\pi N \rightarrow \mu^+ \mu^-$ reaction. Data used consisted of the J/psi events obtained during a 79 GeV run of experiment E-615 at Fermilab. The efficiencies and distributions were calculated for the tracking portion of the detector, consisting of 9 multiwire proportional chamber planes and 16 drift chamber planes. Efficiencies for most of the planes was above 90%, as expected, although a few planes fell below this mark due to failures in the electronics within a section of these planes. Even including these low efficiency planes, the redundancy of spatial information provided by the detector allows high efficiency for the track finding programs. There was no noticeable dependence on the incident particle flux, indicating the detector is capable of operation at an incident flux greater than the 10^7/s used in this experiment. In addition, there was little change in the chamber efficiencies over time. The distribution studies identified the primary source of chamber inefficiencies: electronics failure. The chamber distributions also agreed with those generated using a Monte Carlo program, thus confirming the validity of this program. 11 references.

11549 **(LBL—18546) Thirty years at the forefront: a perspective on the Bevatron/Bevalac.** Alonso, J.R. (Lawrence Berkeley Lab., CA (USA)). Sep 1984. Contract AC03-76SF00098. 10p. (CONF-8410203—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85005109.

From 9. All-Union conference on charged particle accelerators; Dubna, USSR (16 Oct 1984).

The operational experience of the Bevatron can be divided into four major periods: first, the commissioning and early experimental period, when the Bevatron was among the highest-energy machines available (1954-1962); second, a period of increasing beam intensity and higher sophistication in the experimental program (1963-1973); third, the light-ion (A less than or equal to 56) period (1974-1981; and finally, the ongoing heavy-ion period. Reference material for this paper was taken mainly from internal LBL reports and log books.

11550 **(LBL—18626) Report on the 1984 LBL workshop ou detectors for relativistic nuclear collisions.** Schroeder, L.S. (Lawrence Berkeley Lab., CA (USA)). Nov 1984. Contract AC03-76SF00098. 25p. (CONF-841005—4). NTIS, PC A02/MF A01; GPO Dep. File Number DE85004590.

From Instrumentation for heavy ion nuclear research conference; Oak Ridge, TN, USA (22 Oct 1984).

Highlights of the Workshop on Detectors for Relativistic Nuclear Collisions, held March 26-30, 1984, at the Lawrence Berkeley Laboratory are reviewed. (Complete proceedings are available as report LBL-18225.) (WHK)

11551 **(LBL—18731) Charge changing cross sections of relativistic uranium.** Gould, H.; Greiner, D.; Lindstrom, P.; Symons, T.J.M.; Crawford, H.; Thieberger, P.; Wegner, H. (Lawrence Berkeley Lab., CA (USA); Brookhaven National Lab., Upton, NY (USA)). Nov 1984. Contract AC03-76SF00098. 16p. (CONF-841117—34). NTIS, PC A02/MF A01; GPO Dep. File Number DE85004592.

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

We report equilibrium charge state distributions of uranium at energies of 962 MeV/nucleon, 437 MeV/nucleon and 200 MeV/nucleon in low Z and high Z targets and the cross sections for U^{92+} reversible U^{91+} and U^{91+} reversible U^{90+} at 962 MeV/nucleon and 437 MeV/nucleon. Equilibrium thickness Cu targets produce ≅ 5% bare U^{92+} at 200 MeV/nucleon and 85% U^{92+} at 962 MeV/nucleon. 7 references, 5 figures.

11552 **(SLAC-PUB—3455) Performance report for Stanford/SLAC Microstore Analog Memory Unit.** Freytag, D.R.; Walker, J.T. (Stanford Linear Accelerator Center, CA (USA); Stanford Univ., CA (USA)). Sep 1984. Contract AC03-76SF00515. 4p. (CONF-841007—40). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004676.

From Nuclear science symposium; Orlando, FL, USA (31 Oct 1984).

Tests of a newly developed Analog Memory Unit (AMU) are described. The device contains 256 analog storage cells consisting of pass transistors, a storage capacitor and a differential read out buffer. By addressing the storage cells sequentially, the shape of the signal present at the input can be recorded in time. Fast response and good amplitude resolution were the design goals for the development. Measurements on individual devices will be presented and the status of hybridized subsystems containing eight AMUs discussed.

11553 **(SLAC-PUB—3466) Vernier Delay Unit.** Pierce, W.B. (Stanford Linear Accelerator Center, CA (USA)). Oct 1984. Contract AC03-76SF00515. 5p. (CONF-841007—43). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004678.

From Nuclear science symposium; Orlando, FL, USA (31 Oct 1984).

This module will accept differential ECL pulses from the auxiliary rear panel or NIM level pulses from the front panel. The pulses are produced at the output with a fixed delay that is software programmable in steps of 0.1 ns over the range of 0.1 to 10.5 ns. Multiple outputs are available at the front panel. Minimum delay through the module is 9 ns.

11554 **(SLAC-PUB—3471) SLAC Scanner Processor: a FASTBUS module for data collection and processing.** Braf-man, H.; Glanzman, T.; Lankford, A.J.; Olsen, J.; Paffrath, L. (Stanford Linear Accelerator Center, CA (USA)). Oct 1984. Contract AC03-76SF00515. 5p. (CONF-841007—45). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004681.

From Nuclear science symposium; Orlando, FL, USA (31 Oct 1984).

A new, general purpose, programmable FASTBUS module, the SLAC Scanner Processor (SSP), is introduced. Both hardware and software elements of SSP operation are discussed. The role of the SSP within the upgraded Mark II Detector at SLAC is described.

11555 **(WUD—83-1) Production and testing of an s-band resonator with a Nb_3Sn surface.** Peiniger, M. (Wuppertal Univ. (Gesamthochschule) (Germany, F.R.). Fachbereich 8 - Naturwissenschaften 1 - Physik). Jan 1983. 100p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE85750266.

This report describes the preparation of a niobium s-band resonator with Nb_3Sn surface using a special vapor phase deposition method. High-frequency superconductivity tests were performed on this resonator. Measurements of transition temperature, penetration depth, energy gap, and temperature dependence of surface conductivity of Nb_3Sn, and resonator behaviour at high electrical field strengths are reported.

4304 Storage Rings

11556 **(BONN-HE—84-11) Use of MC68000 microprocessors in the TASSO experiment.** Mertens, V. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). Jun 1984. 9p. (CONF-8405162—7). NTIS (US Sales Only), PC A02/MF A01. File Number DE85750275.

From Symposium on recent developments in computing, processor, and software research for high-energy physics; Guanajuato, Mexico (8 May 1984).

A MC68000 based microcomputer system for the enhancement of CAMAC data acquisition systems has been developed at Bonn and DESY. Good software support is available including FORTRAN-77 with real-time extensions and PASCAL. The system will be used in various applications in the online system of the TASSO detector at the e^+e^--storage ring PETRA.

11557 **(DESY—84-060) TASSO vertex detector.** Binnie, D.M.; Cameron, W.; Campbell, A.J.; Foster, B.; Garbutt, D.A.; Jenkins, C.; Jones, W.G.; McCardle, J.; Miller, D.G.; Thomas, J. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Jul 1984. 33p. (IC—84/HENP/2). NTIS (US Sales Only), PC A03/MF A01. File Number DE85750287.

The design, construction and performance of a small pressurized drift chamber of low mass and high wire density is described. The chamber forms part of the TASSO experiment at the PETRA e^+e^- storage ring of the DESY Laboratory. First physics results obtained with the chamber are also briefly discussed.

44 INSTRUMENTATION

4401 Radiation Instrumentation

REFER ALSO TO CITATION(S) 44010011520, 11541, 11543, 11548, 11550, 11554, 11557, 11822, 11864

11558 **(ANL-HEP-CP—84-77) Data preprocessor and compactor for the Soudan 2 nucleon decay experiment.** Dawson, J.W.; May, E.N.; Solomey, N. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 6p. (CONF-841007—44). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004817.

From Nuclear science symposium; Orlando, FL, USA (31 Oct 1984).

This paper describes a prototype preprocessor data-compaction system for the Soudan 2 proton decay search experiment. The Soudan 2 experiment will have more than three million potential data words per event to examine, while less than one percent of these data words will have valid data for typical events. In an effort to reduce the amount of data to be stored and analyzed, a data preprocessor was developed which scans the data words. If a data word is valid (ADC count above a preset threshold), that data word is passed to the host computer for experiment monitoring and storage on magnetic tape. To obtain fast data compression, a hardware comparator is used. The hardware comparator places valid data into a FIFO (first in first out stack) where the host computer can acquire the data through CAMAC. The comparator and FIFO are controlled by a microprocessor (8086 CPU), and the microprocessor is programmed for decision-making and communication between the compactor, CAMAC, the host computer and a local terminal.

11559 **(DESY—84-049) Test of a high resolution drift chamber prototype.** Comminchau, V.; Deutschmann, M.; Draheim, K.J.; Fritze, P.; Hangarter, K.; Hawelka, P.; Herten, U.; Tonutti, M.; Biermann, U.; Roderburg, E. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Jun 1984. 40p. (CONF-8405241—2). NTIS (US Sales Only), PC A03/MF A01. File Number DE85750283.

From Seminar on perspectives for experimental apparatus at future high energy machines; Florence, Italy (21 May 1984).

The performance of a drift chamber prototype for a colliding beam vertex detector in a test beam at DESY is described. At one (two) atmosphere gas pressure a spatial resolution of 40 μm (30 μm) per wire for one cm drift length was achieved with a 100 MHz Flash-ADC system. An excellent double track resolution of better than 300 μm over the full drift length of 5 cm can be estimated.

11560 **(DOE/ER/40025—T1) Design for small angle (0 to 2mr) spectrometer for ep or anti pp collisions at DO.** Coteus, P.; Nauenberg, U. (Colorado Univ., Boulder (USA)). Nov 1982. Contract AC02-81ER40025. 18p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005015.

We present a design for a beam jet spectrometer capable of measuring charged momentum and neutral energy from 0 to 2°. This detector provides a valuable physics measurement both for ep and anti pp, and fits easily into our central detector design.

11561 **(INIS-mf—8891) Optimal linear filters for radiometric transport belt balances.** Wanner, T. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Elektrotechnik). 22 Dec 1982. 116p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE85780119.

Due to a very short measuring path, dynamic measurement can be performed with the radiometric transport band balance. The stochastic perturbations of the measured signal afford the use of adequate filter algorithms. In the case of highly dynamical measurements it may even become necessary to improve the dynamics of the drive system. With essential improvements, the loading measurements can be performed far in front of the belt discharge location. For this purpose a solution is developed on the basis of an op-

timal control loop synthesis. A simpler solution is based on the optimal choice of the measuring point in order to compensate partially for the inertia of the drive. In addition a linear filter is used to process the radiometric signals. For the optimal design of this filter a method is used, which allows to limit the pulse response to a final time interval. As a consequence, analytical equations can be deduced for the calculation and discussion of the expected filter characteristic.

11562 **(KFK—3712) Fast data acquisition system for spectroscopy experiments.** Raich, U. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Physik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik). Jun 1984. 130p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85750299.

The new storage ring for low energy antiprotons LEAR at CERN allows to generate antiproton beams with particle rates, which are several orders of magnitude higher than with older beams. This demands for a new concept of the data acquisition system. For the measurements of the characteristic X-ray spectra of antiprotonic atoms a system was developed, which consists of a microprocessor with large memory and a PDP-11 minicomputer. The microcomputer handles the readout of experimental data, while the minicomputer analyses and displays the acquired data and writes them to magnetic tape. A detailed description of the complete system is given in this work and the first results obtained with the system are shown.

11563 **(LBL—14145-Rev.) Fast timing methods for semiconductor detectors. Revision.** Spieler, H. (Lawrence Berkeley Lab., CA (USA)). Oct 1984. Contract AC03-76SF00098. 22p. (CONF-811012—62-Rev.). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004895.

From IEEE symposium on nuclear science; San Francisco, CA, USA (21 Oct 1981).

This tutorial paper discusses the basic parameters which determine the accuracy of timing measurements and their effect in a practical application, specifically timing with thin-surface barrier detectors. The discussion focusses on properties of the detector, low-noise amplifiers, trigger circuits and time converters. New material presented in this paper includes bipolar transistor input stages with noise performance superior to currently available FETs, noiseless input terminations in sub-nanosecond preamplifiers and methods using transmission lines to couple the detector to remotely mounted preamplifiers. Trigger circuits are characterized in terms of effective rise time, equivalent input noise and residual jitter.

11564 **(MPI-PAE/Exp.El.—132) Tower structured scintillator-lead photon calorimeter using a novel fiber optics readout system.** Fessler, H.; Freund, P.; Gebauer, J.; Glas, K.M.; Pretzl, K.P.; Seyboth, P.; Seyerlein, J.; Thevenin, J.C. (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik). Jun 1984. 18p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85750302.

Described is the construction and the performance of a tower structured scintillator-lead photon calorimeter using a novel fiber optics readout system. The calorimeter is divided into 9 individual towers. Each tower has a cross section of 5x5 cm^2 and consists of 60 layers of 2 mm lead plus 5 mm thick scintillator. The four sides of each tower are covered by thin acrylic sheets (1.5 mm thick) doped with a wavelength shifting material. The light produced in each scintillator plate is first converted in these sheets, then converted a second time in a set of polystyrene optical fibers (diameter 2 mm) which run longitudinally through the calorimeter along the corners of each tower. A small diameter photomultiplier was attached to the fibers at the back end of the calorimeter. The obtained energy resolution with incident electrons in the range of 0.25 - 5.0 GeV/c is sigma/E = $0.10/\sqrt{E}$. The uniformity of response across the front face of each tower was measured.

11565 **(PB—84-224039) Applications of new absolute measurements of x-rays and gamma-rays. Final report.** Deslattes, R.D. (National Bureau of Standards, Washington, DC (USA)). 1983. 12p. Pub. in Proceedings of NATO Advanced Study Institute Quantum Metrology Fundamental Phys. Constants, Erice, Italy, November 16-28, 1981, p353-364 1983.

The technology described in the previous lecture has resulted in a new array of gamma-ray secondary standards and convenient, accurate procedures for re-measurement of X-ray lines. First use of the new gamma-ray reference lines has been in normalization of muonic and pionic atom spectra. Primary results so far have been in improved tests of QED using muonic spectra and in reconciliation of different routes to the pion mass. Additional work on X-ray absorption edges has led to a new value for the mass of K(-) and will be used in an experiment on pionic deuterium. Re-study of especially mid- to high-Z spectra of normal atoms has been encouraged by newly available relativistic self-consistent field calculations. Detailed comparisons appear informative regarding systematic trends in the discrepancies.

11566 **(PNL-SA—12758) ^{76}Ge double beta decay experiment at Homestake.** Brodzinski, R.L.; Brown, D.P.; Evans, J.C. Jr.; Hensley, W.K.; Reeves, J.H.; Wogman, N.A.; Avignone, F.T. III; Miley, H.S. (Pacific Northwest Lab., Richland, WA (USA); South Carolina Univ., Columbia (USA)). Aug 1984. Contract AC06-76RL01830. 11p. (CONF-8408132—7). NTIS, PC A02/MF A01; GPO Dep. File Number DE85005286.

From Conference on solar neutrinos and neutrino astronomy; Lead, SD, USA (23 Aug 1984).

An ultralow background intrinsic Ge detector has been developed over several generations of experiments. The radioactive background from construction materials has been reduced by more than two orders of magnitude. The sources of background in a standard commercial cryostat have been identified and eliminated. Data are presented taken with this 135 cm^3 prototype, installed in the Homestake Gold Mine. A large (1440 cm^3) detector and data acquisition system are under construction and are also described. 11 references, 4 tables, 2 figures.

11567 **(SLAC-PUB—3465) Circulating water cooling system for a Camac Crate.** Pierce, W.B. (Stanford Linear Accelerator Center, CA (USA)). Oct 1984. Contract AC03-76SF00515. 5p. (CONF-841007—42). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004679.

From Nuclear science symposium; Orlando, FL, USA (31 Oct 1984).

This paper describes a circulating water cooling system used at SLAC for cooling and maintaining cleanliness of the SLC type Camac Crates.

11568 **(SLAC-PUB—3475) New drift chamber for the Mark II detector at the SLAC Linear Collider.** Burchat, P.R.; Hanson, G.G.; Sadrozinski, H.F.W. (Stanford Linear Accelerator Center, CA (USA)). Oct 1984. Contract AC03-76SF00515. 5p. (CONF-841007—50). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005533.

From Nuclear science symposium; Orlando, FL, USA (31 Oct 1984).

The design of the new cylindrical drift chamber for the Mark II detector at the SLAC Linear Collider is described. Prototype tests to determine the working parameters of the chamber and to study possible gas mixtures are discussed.

11569 **(SLAC-PUB—3491) SLAC Mark II upgrade drift chamber front end electronics.** Briggs, D.; Burchat, P.; Dorfan, D.; Gioumousis, A.; Horelick, D.; Hutchinson, D.; Lankford, A.; Porat, D.; Sadrozinski, H.; Seiden, A. (Stanford Linear Accelerator Center, CA (USA)). Oct 1984. Contract AC03-76SF00515. 5p. (CONF-841007—46). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004680.

From Nuclear science symposium; Orlando, FL, USA (31 Oct 1984).

The SLAC Mark II detector is being improved by the addition of a new main drift chamber and associated electronics to prepare it for operations as the first detector at SLC. Presented here are the initial signal processing electronics, the preamplifiers, amplifiers and discriminators for the 5832 sense wires, which are located on the detector itself. The performance of the detector is established almost entirely by the drift chamber and these electronics.

11570 **(SLAC-PUB—3502) Cerenkov ring imaging detector development for SLD.** Williams, S.; Ashford, V.; Bird, F.; Leith, D.W.G.S.; Shimomura, T.; Shapiro, S.; Nuttall, A; Yellin, S. (Stanford Linear Accelerator Center, CA (USA); California Univ., Santa Barbara (USA). Dept. of Physics). Nov 1984. Contract AC03-76SF00515. 6p. (CONF-841007—51). NTIS, PC A02. File Number DE85005535.

From Nuclear science symposium; Orlando, FL, USA (31 Oct 1984).

Progress in the development of a time projection style photoelectron detector is reported. The development is intended to demonstrate the principles and determine specifications for a practical design of the large CRID device recently described in the SLD design report, wherein a large detector for the Stanford Linear Collider is described. The drift detector utilizes the technique of photo-ionization of Cerenkov light in tetrakis-dimethyl-amino-ethylene (TMAE) vapor at (1700 to 2200 A), and drifting the photoelectrons ten's of centimeters to a proportional chamber picket fence, where the drift time provides one coordinate and the wire number the other coordinate. Results are reported on the drifting of photoelectrons from the Cerenkov light and a light pulser over distances of 10 to 60 centimeters.

11571 **Wire chamber radiation detector with discharge control.** Perez-Mendez, V.; Mulera, T.A. (to Dept. of Energy). US Patent 4,465,933. 14 Aug 1984. Filed date 29 Mar 1982. vp.

PAT-APPL-363201.

A wire chamber radiation detector has spaced apart parallel electrodes and grids defining an ignition region in which charged particles or other ionizing radiations initiate brief localized avalanche discharges and defining an adjacent memory region in which sustained glow discharges are initiated by the primary discharges. Conductors of the grids at each side of the memory section extend in orthogonal directions enabling readout of the X-Y coordinates of locations at which charged particles were detected by sequentially transmitting pulses to the conductors of one grid while detecting transmissions of the pulses to the orthogonal conductors of the other grid through glow discharges. One of the grids bounding the memory region is defined by an array of conductive elements each of which is connected to the associated readout conductor through a separate resistance. The wire chamber avoids ambiguities and imprecisions in the readout of coordinates when large numbers of simultaneous or near simultaneous charged particles have been detected. Down time between detection periods and the generation of radio frequency noise are also reduced.

11572 **Liquid scintillation alpha spectrometry techniques.** McKlveen, J.W. (Arizona State Univ., Tempe (USA). Coll. of Engineering and Applied Sciences); McDowell, W.J. (Oak Ridge National Lab., TN (USA). Chemical Technology Div.). *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment;* **223**: No. 2/3, 372-376(15 Jun 1984). (CONF-830539—).

From International meeting for radionuclide metrology - alpha particle spectrometry and low level measurement; Harwell, UK (10 May 1983).

Accurate, quantitative determinations of alpha emitting nuclides by conventional plate counting methods are difficult, because of sample self-absorption problems in counting and because of non-reproducible losses in conventional sample separation methods. Liquid scintillation alpha spectrometry offers an attractive alternative with no sample self-absorption or geometry problems and with 100% counting efficiency. Sample preparation may include extraction of the alpha emitter of interest by a specific organic phase-soluble compound directly into the liquid scintillation counting medium. Detection electronics use energy and pulse-shape discrimination, to yield alpha spectra without beta and gamma background interference. Specific procedures have been developed for gross alpha, uranium, plutonium, thorium and polonium assay. Possibilities for a large number of other applications exist. Accuracy and reproducibility are typically in the 1% range. Backgrounds of the order of 0.01 cpm are readily achievable. The paper will present an overview of liquid scintillation alpha counting techniques and some of the results achieved for specific applications.

4403 Miscellaneous Instruments

REFER ALSO TO CITATION(S) 44030010853

11573 **Muon spin relaxation.** Heffner, R.H.; Fleming, D.G. (Los Alamos Meson Physicis Facility at Los Alamos National Laboratory, New Mexico). *Physics Today;* **37**: No. 12, 38-46(Dec 1984).

In an ingenious application of parity violation, physicists are measuring interstitial magnetic fields and diffusion in solids by analyzing the anisotropy in the decay of injected spin-polarized positive muons.

11574 **Outline of a variational formulation of zone-plate theory.** Tatchyn, R.; Csonka, P.L.; Lindau, I. (Stanford Synchrotron Radiation Laboratory, Stanford University, Stanford, California 94305). *Journal of the Optical Society of America B: Optical Physics;* **1**: No. 6, 806-811(Dec 1984).

Transmission zone plates composed of materials describable by the complex index of refraction n [n = (1-δ)+ik] modulate both the amplitude and the phase of the light passing through them. In this paper, a general variational approach to the design of zone-plate profiles that maximize system transfer functions, such as I/ sup(m/)/I/sub IN/ or I/sup(m/)/I/sub OUT/ (where I/sub IN/ and I/sub OUT/ are the total input and output powers and I/sup(m/) is the mth-order diffracted power), is presented in terms of the real and imaginary components of n. The variational problem, as formulated here, is shown to generate some important classical zone-plate configurations as special solutions and to lead naturally to the derivation of the most general zone-plate configurations possible. Some specific optimum solutions are derived for gold in the soft-x-ray range and are tabulated for covenient reference.

11575 **Low-energy x-ray response of photographic films. II. Experimental characterization.** Henke, B.L.; Fujiwara, F.G.; Tester, M.A.; Dittmore, C.H.; Palmer, M.A. (University of Hawaii, Honolulu, Hawaii 96822). *Journal of the Optical Society of America B: Optical Physics;* **1**: No. 6, 828-849(Dec 1984). Contract AS08-83DP40181.

Optical density versus exposure data have been obtained at nine photon energies in the 100—2000-eV x-ray region for five spectroscopic films (Kodak films 101-07, SB-392, RAR 2492, RAR 2495, and RAR 2497). These data were determined operationally by a direct comparison of the peak absolute intensities of spectral lines, which were measured with a calibrated proportional counter, with the microdensitometer tracings of the corresponding photographically recorded spectral lines. Film-resolution limits were deduced from an analysis of contact microradiograms of linear zone plates constructed of gold bars. The relationship between the specular densities as measured here and the diffuse densities have been experimentally determined for the five films. Finally, experimental measurements of the optical density versus the angle of incidence of exposing radiation of constant intensity were obtained. These data, relating density to the x-ray intensity, its photon energy, and its angle of incidence, are shown to be fitted satisfactorily in the 100—10 000-eV region by the semiempirical mathematical model relations that were derived in Part I of this research [J. Opt. Soc. Am. B 1, 818—827 (1984)].

11576 **Braking system for use with an arbor of a microscope.** Norgren, D.U. (to Dept. of Energy). US Patent 4,470,484. 11 Sep 1984. Filed date 23 Sep 1982. vp.

PAT-APPL-422512.

A balanced braking system comprising a plurality of braking assemblies located about a member to be braked. Each of the brak-

ing assemblies consists of a spring biased piston of a first material fitted into a body of a different material which has a greater contraction upon cooling than the piston material. The piston is provided with a recessed head portion over which is positioned a diaphragm and forming a space therebetween to which is connected a pressurized fluid supply. The diaphragm is controlled by the fluid in the space to contact or withdraw from the member to be braked. A cooling device causes the body within which the piston is fitted to contract more than the piston, producing a tight shrink fit therebetween. The braking system is particularly applicable for selectively braking an arbor of an electron microscope which immobilizes, for example, a vertically adjustable low temperature specimen holder during observation. The system provides balanced braking forces which can be easily removed and re-established with minimal disturbance to arbor location.

11577 **Photoelectrochemical imaging.** Butler, M.A. (Sandia National Laboratories, Albuquerque, New Mexico). *Journal of the Electrochemical Society;* **131**: 2185-2190(Sep 1984).

A device is described for producing video images from localized photocurrent measurements on electrode surfaces. Images generated from photoinduced electron-hole pair currents in passivating oxide layers on polycrystalline titanium and high resistance polycrystalline GaP photoelectrodes are shown as examples. The applicability of this device for producing images from other optically induced effects is also discussed. It is proposed that the localized heating from a focused laser beam can be used to image the current distribution on metal electrodes.

11578 **Multichannel random pulse counter.** Baksay, L.A.; Smith, M.C. (Stanford Univ., CA). *Journal of Physics E: Scientific Instruments;* **16**: 666-668(1983). Contract AC03-76SF00515.

The authors have designed and built a gated 64-channel random pulse input register and controller unit. In conjunction with segments of a commonly used LeCroy q Vt multichannel analyser, it comprises a stand-alone counter system which is useful in experiments with a large number of detectors. In particular, when hardware and software components are still in the debugging phase, this device can largely reduce the labour of data taking diagnosis. Input and output levels of the device are TTL for general compatibility. In its present configuration, the system can be used wherever samples of random pulses with rates up to 2 kHz per channel must be taken on up to 64 channels simultaneously, for example in cosmic ray tests. After making minimal modifications to the unit, rates to about 10 kHz can be accepted.

11579 **Thermal ion source for quadrupole mass spectrometers.** McKown, H.S.; Smith, D.H.; Sherman, R.L. (Oak Ridge National Lab., TN). *International Journal of Mass Spectrometry and Ion Physics;* **51**: 39-46(1983). Contract W-7405-ENG-26.

A new ion source has been designed and tested for performing thermal ionization isotopic analyses with a quadrupole mass spectrometer. Significantly improved performance in comparison to the commercial source was obtained.

11580 **Micro-column plasma emission liquid chromatograph.** Gay, D.D. (to Dept. of Energy). US Patent 4,470,699. 11 Sep 1982. Filed date 12 Aug 1982. vp.
PAT-APPL-407538.

In a direct current plasma emission spectrometer for use in combination with a micro-column liquid chromatograph, an improved plasma source unit. The plasma source unit includes a quartz capillary tube having an inlet means, outlet off gas means and a pair of spaced electrodes defining a plasma region in the tube. The inlet means is connected to and adapted to receive eluant of the liquid chromatograph along with a stream of plasma-forming gas. There is an opening through the wall of the capillary tube penetrating into the plasma region. A soft glass capillary light pipe is disposed at the opening, is connected to the spectrometer, and is adapted to transmit light passing from the plasma region to the spectrometer. There is also a source of electromotive force connected to the electrodes sufficient to initiate and sustain a plasma in the plasma region of the tube.

45 EXPLOSIONS AND EXPLOSIVES

4501 Chemical

REFER ALSO TO CITATION(S) 45010010952

11581 **(ORNL/TM—9289) High explosive testing of a corrugated metal blast shelter with membrane blast doors.** Zimmerman, G.P.; Chester, C.V. (Oak Ridge National Lab., TN (USA)). Dec 1984. Contract AC05-84OR21400. 73p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85004109.

In October 1983 the Defense Nuclear Agency (DNA) sponsored a high-explosive blast test, nicknamed DIRECT COURSE. This event simulated the blast effects from a one-kiloton nuclear detonation and provided an environment for the testing of selected blast and fallout shelters for their structural integrity. Under work for the Federal Emergency Management Agency (FEMA), the Oak Ridge National Laboratory (ORNL) fielded a set of experiments at the DIRECT COURSE event which were directed toward reducing the cost of blast shelter for small groups of people, such as workers in critical industries (keyworkers). Six items were tested: three scale models of a corrugated metal blast shelter and three full-size blast door closures for such a shelter. The three shelters survived blast overpressures up to 2.55 MPa (225 psi), a level which is equivalent to being approximately 800 m (0.5 mile) from a 1 megaton nuclear detonation. Each shelter model was 180 cm (6 ft.) long by 60 cm (2 ft.) in diameter, was buried about 60 cm (2 ft.) below ground level, and represented a 1/4-scale version of a full-size blast shelter which would be capable of supporting 12 to 18 occupants. The three full-size, 90 cm (35 in.) diameter, blast doors for such a shelter also successfully resisted the same range of blast overpressure. Each door weighed less than 45 kg (100 lb) and incorporated a novel, yielding-membrane design. These sheet metal membranes were between 1.3 and 2.0 mm (0.050 and 0.080 in.) thick and were supported by an edge beam (hoop).

11582 **(UCID—20310) Model for high rate gas flows in deformable and reactive porous beds.** Weston, A.M. (Lawrence Livermore National Lab., CA (USA)). 8 Jan 1985. Contract W-7405-ENG-48. 80p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85006140.

This report presents the development of a one dimensional planar Lagrange hydrodynamic computer model which describes the processes preceding detonation. The model treats gas flow, deflagration, and compaction in a porous bed of reactive material. The early part of deflagration to detonation experiment with porous HMX is simulated. Sensitivity of the simulation calculation to ignition and burn rate parameters is illustrated and discussed. The effects of changing the mean particle size of the porous material are investigated. There is widespread interest in runaway reaction hazards that may be associated with porosity in propellant and explosive materials. Experimentally, such reactions are initiated and observed in long, thick walled hollow tubes, filled with a granular porous bed of reactive material. We will present comparisons with an experiment on porous HMX to illustrate details of the model and to point out what we believe are important features of the observed phenomenon. A geometric finite element cell is devised that allows gas to flow through a compacting matrix. The experimental simulation considers the DDT process from initial squib burn through the onset of general matrix deflagration (convective burning), to the development of a fully dense compaction wave. While this simulation did not calculate turnover to detonation, it did illustrate that the transition occurred as soon as the compaction wave became fully dense. It is shown that deflagration and gas permeation lags compaction at the time of transition. This suggests that the actual transition involves an additional compaction dependent process. 18 references, 20 figures, 3 tables.

11583 **Short-duration shock initiation of triaminotrinitrobenzene (TATB).** Seitz, W.L. (Los Alamos National Lab., NM). pp 531-534 of Shock waves in condensed matter, 1983. Asay, J.R.; Graham, R.A.; Straub, G.K. (eds.). Amsterdam, Holland; Elsevier Science Publishers B.V. (1984).

From American Physical Society topical conference; Sante Fe, NM, USA (18-21 Jul 1983).

The explosive-wedge technique and explosively generated sustained and short-duration shocks were used to study the effects of both particle size and initial temperature on the initiation of TATB. The explosives studied were a 1.89-g/cm^3 plastic-bonded material (95% TATB/5% Kel F) and a 1.8-g/cm^3 (7% porous) pure TATB with three different particle-size distributions for each material in the range of 1 to 80 μm. Initial sample temperatures ranged from 218 to 293 K. Sustained-shock experiments showed a strong initial temperature effect, but only the smallest particle size, pure TATB showed a distinct particle-size effect. Short-duration-shock experiments showed both a strong particle-size and strong initial-temperature effect.

11584 **Burning topology in the shock-induced reaction of heterogeneous explosives.** Wackerle, J.; Anderson, A.B. (Los Alamos National Lab., NM). pp 601-604 of Shock waves in condensed matter: 1983. Asay, J.R.; Graham, R.A.; Straub, G.K. (eds.). New York, NY, USA; Elsevier Science Publishers B.V. (1984).

In several models of the shock-induced decomposition of heterogeneous explosives, it is assumed that the shock generates a small amount of decomposition at microscopic hot spots, and that the reaction is completed by surface burning progressing at the interface between the gaseous products and the unreacted solid. Experimentally determined reaction rates were used in heterogeneous explosives to calculate the interface velocities for outward-burning spherical holes and inward-burning spherical grains. It was found that reaction rates early in the decomposition are too large to support a simple pressure-dependent hole-burning model, and that a grain-burning model could be more feasible.

4502 Nuclear

REFER ALSO TO CITATION(S) 45020011581, 11597

11585 (UCRL—52000-84-12, pp 20-31) **Initiation studies of TATB-based high explosives.** Dec 1984. NTIS, PC A03/MF A01. File Number DE85005541.

In Energy and Technology Review.

TATB-based explosives have unique safety properties that make them very attractive as the explosive in conventional and nuclear weapon systems. We review here the safety tests and experimental observations that have enabled us to design detonation systems for TATB weapons that perform reliably over the entire stockpile-to-target sequence.

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

5001 Basic Studies

REFER ALSO TO CITATION(S) 50010011438

11586 **(DOE/EV/10665—5) Variation of Arctic cloud cover in summer.** Kukla, G.J. (Columbia Univ., Palisades, NY (USA). Lamont-Doherty Geological Observatory). Dec 1984. Contract AC02-81EV10665. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85004507.

The variation of Arctic cloud cover in time and space during the summers of 1979, 1977 and part of 1978 was charted from satellite imagery in 3 to 7 day intervals. Three classes of cloud thickness were separately mapped. Confirming the finding of the earlier report dealing with the 1979 data, the optically thick clouds were found to be considerably less common than expected from earlier analyses of drifting station reports. The proportion of thick cloud increased in connection with low pressure systems advecting continental air masses over the Arctic Basin. The data available to date indicate that the thickest cloud cover over the central Arctic was observed in August. Throughout spring and summer of the analysed years, clear sky episodes all over the Arctic Basin lasted long enough to significantly affect the surface radiation balance and the dissipation of snow and ice cover. Our results indicate that general circulation models require realistic representation of poleward advection of continental air masses and of the conditions accompanying snow and ice melt. 16 references.

11587 **Observations of a drainage flow event on a high-altitude simple slope.** Clements, W.E.; Nappo, C.J. (Los Alamos National Lab., NM). *Journal of Climate and Applied Meteorology;* **22**: No. 2, 331-335(Feb 1983).

Observations of a drainage flow event on a high-altitude simple slope were made for a few hours during a five-day field study that was otherwise characterized by high and gusty winds blowing across the face of the slope believed due to the presence of a nocturnal jet. A simple slope in the Jemez Mountains of north-central New Mexico was instrumented with meteorological surface stations and 10 m masts. Data collected during the drainage flow event indicate a depth ranging from greater than 10 m at the bottom of the slope to near zero at the top. At the bottom of the slope, the wind speed varied from 2.5 m s^{-1} at 1.5 m above ground to 0.5 m s^{-1} at a height of 10 m.

5002 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 50020010868, 10870, 11195, 11205, 11429, 11455, 11607, 11617

11588 **(CONF-8410165—3) Field validation of six-particle puff model.** Sheih, C.M. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 18p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85004073.

From DOE model validation workshop; Charleston, SC, USA (23 Oct 1984).

Simulations with a puff dispersion model for atmospheric pollutants, developed at Argonne National Laboratory, have been compared with field data from the Mesoscale Atmospheric Transport Studies (MATS) at Savannah River Laboratory, South Carolina. The model treats a plume from a continuous source as a series of puffs emitted from the source. Each puff is represented by a set of six tracer particles, which define the size, shape and location of the puff. Initially, these particles are located at the surface of the source, on arbitrarily chosen orthogonal axes. The new locations of the particles are computed at each time step by taking into account advection, eddy diffusion, wind shear and entrainment of ambient air during puff rise. Calculations of puff rise are carried out by solving conservation equations of mass, momentum, and energy with a finite-difference method. The concentration distribution of each puff is determined by assuming a three-dimensional Gaussian distribution and fitting an ellipsoid to the six particles so that standard deviations of concentrations correspond to half-lengths of the principle axes of the ellipsoid. The concentration at a point of interest is obtained by summing the contributions from nearby puffs. Fourteen tracer releases were simulated, with a correlation coefficient between observed and simulated peak concentrations of 0.57. The average simulated peak concentration was 18% larger than the average observed peak concentration, while the standard deviation of the simulated peak concentration was 81% of the observed peak concentration. 9 references, 5 figures.

11589 **(N—84-30566) Stratospheric NO and NO2 profiles at sunset from analysis of high-resolution balloon-borne infrared solar absorption spectra obtained at 33 deg N and calculations with a time-dependent photochemical model.** Rinsland, C.P.; Boughner, R.E.; Larsen, J.C.; Goldman, A. (National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center). Aug 1984. 46p. (NASA-TM—86285). NTIS, PC A03/MF A01.

Simultaneous stratospheric vertical profiles of NO and NO2 at sunset were derived from an analysis of infrared solar absorption spectra recorded from a float altitude of 33 km with an interferometer system during a balloon flight. A nonlinear least squares procedure was used to analyze the spectral data in regions of absorption by NO and NO2 lines. Normalized factors, determined from calculations of time dependent altitude profiles with a detailed photochemical model, were included in the onion peeling analysis to correct for the rapid diurnal changes in NO and NO2 concentrations

with time near sunset. The CO2 profile was also derived from the analysis and is reported.

11590 **(PB—84-223627) Evaluation of alternative gaussian plume dispersion modeling techniques in estimating short-term sulfur dioxide concentrations.** Pierce, T.E. (Environmental Protection Agency, Research Triangle Park, NC (USA). Environmental Sciences Research Lab.). Jul 1984. 151p. (EPA—600/3-84/079). NTIS, PC A08/MF A01.

A routinely applied atmospheric dispersion model was modified to evaluate alternative modeling techniques which allowed for more detailed source data, onsite meteorological data, and several dispersion methodologies. These were evaluated with hourly SO2 concentrations measured at fixed receptors around coal-fired power plants near Paradise, Kentucky, during 1976 and near Johnsonville, Tennessee, during 1977. A significant finding of the evaluation was that the more sophisticated models did not appreciably 'outperform' the routinely applied models. The models using airport meteorological data performed as well as the models using onsite wind data. With the Pasquill-Gifford and Briggs dispersion schemes, small differences in model performance were observed. More substantial differences occurred with models using onsite turbulence measurements. The model using Pasquill's recommendations tended to overpredict peak concentrations. The models based on Draxler's and Cramer's approaches using onsite turbulence yielded mixed results perhaps in part because the lateral standard deviation of wind direction available was the one-hour average of five-minute values (rather than a one-hour value) thus eliminating the longer period fluctuations that are of importance in estimating one-hour concentrations in addition to the shorter period fluctuations. Additional research is recommended to improve the application of onsite turbulence measurements and to provide more accurate estimates of plume trajectories for input to atmospheric dispersion models.

11591 **(PB—85-117638/XAB) Acid rain and forestry.** Binns, W.O. (Forestry Commission, Edinburgh (UK)). 1984. 21p. NTIS, PC E03/MF E03.

Contents include: Pollution levels; Acidity of rainfall; Direct effects of pollutants on plants; Interactions in forest canopies; Effects of pollutants acting through the soil; Direct effects of pollutants on fresh waters; Interactions of pollutants with forests and consequent effects on water quality; Forest decline in central Europe; British forests and acid depositions.

11592 **(PNL—4046-Ed.2) PLUVIUS: a generalized one-dimensional model of reactive pollutant behavior, including dry deposition, precipitation formation, and wet removal. Second edition.** Easter, R.C.; Hales, J.M. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1984. Contract AC06-76RL01830. 220p. NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE85005542.

This report is a second-edition user's manual for the PLUVIUS reactive-storm model. The PLUVIUS code simulates the formation of storm systems of a variety of types, and characterizes the behavior of air pollutants as they flow through, react within, and are scavenged by the storms. The computer code supplied with this report is known as PLUVIUS MOD 5.0, and is a substantial improvement over the MOD 3.1 version given in the original user's manual. Example applications of MOD 5.0 are given in the report to facilitate rapid application of the code for a variety of specific uses. 22 references, 7 figures, 48 tables.

11593 **(PNL—5152-Pt.4) OSCAR experiment high-density network data report: Event 4 - April 21-23, 1981.** Dana, M.T.; Easter, R.C.; Thorp, J.M. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1984. Contract AC06-76RL01830. 249p. NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE85005430.

The OSCAR (Oxidation and Scavenging Characteristics of April Rains) experiment, conducted during April 1981, was a cooperative field investigation of wet removal in cyclonic storm systems. The high-density component of OSCAR was located in northeast Indiana and included sequential precipitation chemistry measurements on a 100 by 100 km netwok, as well as airborne air chemistry and cloud chemistry mueasurements, surface air chemistry measurements, and supporting meteorological measurements. Four separate storm events were studied during the experiment. This report summarizes data taken by Pacific Northwest Laboratory (PNL) during the fourth storm event, April 21-23. The report contains the high-density network precipitation chemistry data, air and cloud chemistry data from the two PNL aircraft, and meteorological data for the event, including standard National Weather Service products and radar and rawindsonde data from the event. 3 references, 80 figures, 11 tables.

11594 **(PNL—5298) MAP3S precipitation chemistry network: seventh periodic summary report, 1983.** Rothert, J.E.; Dana, M.T. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1984. Contract AC06-76RL01830. 351p. NTIS, PC A16/MF A01; GPO Dep. File Number DE85005324.

This summary report, the seventh in the series, contains complete field and chemical data from the MAP3S Precipitation Chemistry Network for the year 1983. Sections cover QA/QC of the MAP3S/PCN; network history, network site information and a MAP3S/PCN bibliography; and a brief statistical look at the laboratory operations for 1983. There is also a brief statistical summary for 1982 to 1983. Included under the Quality Control section are the QA audits for site performance, laboratory comparisons, field blank and pH test results, and sample shipping and analysis results. Included is a listing of cooperating organizations and personnel for the MAP3S/PCN. 10 references, 10 figures, 32 tables.

11595 **(TVA/OP/CEM—84/48-Vol.2) Tennessee Valley Authority/Bonneville Power Administration Indoor Air Quality Study. Volume II.** (Tennessee Valley Authority, Chattanooga (USA). Div. of Conservation and Energy Management). Oct 1984. 268p. NTIS, PC A12/MF A01; 1; GPO Dep. File Number DE85000041.

This volume of the test report will present descriptions of the TSP/Nephelometer model and the air infiltration model, a listing of the FORTRAN computer model used to generate pollutant source strengths, and a graphical display of the complete data base. Calcomp plots of wood weight; indoor and outdoor concentrations of carbon monoxide (CO), nitric oxide (NO), nitrogen dioxide (NO_2), nitrogen oxides (NO/sub x/) and particulates; hourly source strengths of CO, NO, NO_2, and NO/sub x/; and hourly air exchange rates (ACPH); versus time will be included.

11596 **(TVA/OP/CEM—84/84-Vol.1) Tennessee Valley Authority/Bonneville Power Administration indoor air quality study. Volume I.** (Tennessee Valley Authority, Chattanooga (USA). Energy Use Test Facility Staff). Aug 1984. 196p. NTIS, PC A09/MF A01; GPO Dep. File Number DE85004489.

This study was developed to gain information on indoor air quality as related to the operation of both conventional and new technology wood heaters in a relatively tight, unoccupied home. Two conventional airtight wood heaters and two new catalytic wood heaters were used in the study. The indoor concentration of CO was elevated over outdoor concentrations. The maximum one-hour indoor concentration of CO was found to be 9.1 ppM with the primary NAAQS for CO being 35 ppM. In addition to CO, wood heaters were found to be sources of polycyclic aromatic hydrocarbons, benzo(a)pyrene and particulates; however, wood heaters did not significantly affect NO/sub x/ levels. 28 references, 73 figures, 31 tables.

11597 **(UCRL—91446) Effects of interactive transport and scavenging of smoke on the calculated temperature change resulting from large amounts of smoke.** MacCracken, M.C.; Walton, J.J. (Lawrence Livermore National Lab., CA (USA)). Dec 1984. Contract W-7405-ENG-48. 22p. (CONF-8408122—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85006450.

From 4. international conference on nuclear war; Erice, Sicily, Italy (19 Aug 1984).

Several theoretical studies with numerical models have shown that substantial land-surface cooling can occur if very large amounts ($\sim 100 \times 10^{12} = 100$ Tg) of highly absorbing sooty-particles are injected high into the troposphere and spread instanta-

neously around the hemisphere (Turco et al., 1983; Covey et al. 1984; MacCracken, 1983). A preliminary step beyond these initial calculations has been made by interactively coupling the two-layer, three-dimensional Oregon State University general circulation model (GCM) to the three-dimensional GRANTOUR trace species model developed at the Lawrence Livermore National Laboratory. The GCM simulation includes treatment of tropospheric dynamics and thermodynamics and the effect of soot on solar radiation. The GRANTOUR simulation includes treatment of particle transport and scavenging by precipitation, although no satisfactory verification of the scavenging algorithm has yet been possible. We have considered the climatic effects of 150 Tg (i.e., the 100 Mt urban war scenario from Turco et al., 1983) and of 15 Tg of smoke from urban fires over North America and Eurasia. Starting with a perpetual July atmospheric situation, calculation of the climatic effects as 150 Tg of smoke are spread slowly by the winds, rather than instantaneously dispersed as in previous calculations, leads to some regions of greater cooling under the denser parts of the smoke plumes and some regions of less severe cooling where smoke arrival is delayed. As for the previous calculations, mid-latitude decreases of land surface air temperature for the 150 Tg injection are greater than 15°C after a few weeks. For a 15 Tg injection, however, cooling of more than several degrees centigrade only occurs in limited regions under the dense smoke plumes present in the first few weeks after the injection. 10 references, 9 figures.

11598 **(UCRL—91830) Results of recent large-scale NH_3 and N_2O_4 dispersion experiments.** Koopman, R.P.; McRae, T.G.; Goldwire, H.C. Jr.; Ermak, D.L.; Kansa, E.J. (Lawrence Livermore National Lab., CA (USA)). Nov 1984. Contract W-7405-ENG-48. 26p. (CONF-8411134—2). NTIS, PC A03/MF A01; GPO Dep. File Number DE85004988.

From 3. symposium on heavy gases and risk assessment; Bonn, F.R. Germany (12 Nov 1984).

Large-scale spill tests of ammonia (NH_3) and nitrogen tetroxide (N_2O_4) were recently performed at the Nevada Test Site (NTS). The tests were extensively instrumented, resulting in large amounts of data which can be used to quantitatively describe the observed phenomena. Preliminary results from both test series indicate that aerosols play a very important role in dense gas dispersion. The test data are ideally suited for model vaidation, and several example model-data comparions are included in this paper. Gaussian model calculations are found to be inadequate even at long distances downwind. New and unexpected phenomena were observed and will be discussed. 15 references, 8 figures, 7 tables.

11599 **(UCRL—91854) Evaluation of a series of SF_6 tracer releases using the MATHEW/ADPIC model.** Rodriguez, D.J.; Rosen, L.C. (Lawrence Livermore National Lab., CA (USA)). Dec 1984. Contract W-7405-ENG-48. 19p. (CONF-8410165—4). NTIS, PC A02/MF A01; GPO Dep. File Number DE85004989.

From DOE model validation workshop; Charleston, SC, USA (23 Oct 1984).

The MATHEW/ADPIC atmospheric transport and diffusion model is evaluated. It uses data provided by the Mesoscale Atmospheric Transport Studies (MATS) developed at the Savannah River Laboratory. The MATS data base contains the results of 14 tracer experiments conducted in and around the Savannah River Plant (SF_6 was released and sampled along a single arc of receptors 30 km from the source). The model was used to predict the spacial distributions of SF_6 for all 14 experiments. The subject of model sensitivity is also explored. While recognizing the episodic and site dependent nature of any results, a tentative ranking of selected unputs in terms of the sensitivity of the model to their variation is provided. 11 references, 8 figures, 2 tables. (MF)

11600 **Acid precipitation: natural versus anthropogenic components.** Galloway, J.N.; Likens, G.E.; Hawley, M.E. (Univ. of Virginia, Charlottesville). *Science (Washington, D.C.);* **226**: 829-830(16 Nov 1984).

The concentrations of H^+, SO_4^{2-}, and NO_3^- in the precipitation of eastern North America are greater now than they were historically as a result of fossil-fuel combustion. Because of a lack of data prior to 1950, the absolute increases in the concentrations of these three ions are unknown. This problem can be addressed by comparing the composition of precipitation from areas sensitive to acidic deposition with that of precipitation from remote areas. An analysis of precipitation data indicates that many areas of eastern North America receive precipitation with substantially greater H^+, SO_4^{2-}, and NO_3^- concentrations than remote areas. For example, SO_4^{2-}, the most ecologically significant indicator of change, is enriched 2 to 16 times in eastern North American precipitation relative to its concentration in remote areas.

11601 **Background Tropospheric Aerosols: Incorporation within a statistical-dynamical climate model.** Potter, G.L.; Cess, R.D. (Lawrence Livermore National Laboratory, University of California). *Journal of Geophysical Research;* **89**: No. D6, 9521-9526(20 Oct 1984).

To evaluate the possible influence of natural background tropospheric aerosols upon the earth's present climate, we have incorporated aerosol radiation models for continental and maritime aerosols into the Lawrence Livermore National Laboratory statistical-dynamical climate model. The model results suggest that background tropospheric aerosols produce 3°-4°C global surface cooling, with maximum cooling occurring at high latitudes, results which are essentially consistent with an energy balance climate model study by Coakley et al. (1983). To specifically delineate effects caused directly by the aerosols, as opposed to indirect effects resulting from aerosol-induced climate change, a second climate perturbation was considered that consisted of reducing the solar constant so as to give exactly the same initial reduction in surface-atmosphere solar absorption as for the inclusion of tropospheric aerosols. These separate climate perturbations produced nearly identical climate feedback effects, together with similar changes in atmospheric stability and hydrological cycle, despite the fact that the two perturbations have quite different latitudinal and vertical distributions. This finding is consistent with a general circulation model study by Manabe and Wetherald (1980) concerning perturbations of both atmospheric CO_2 and the solar constant. A related conclusion is that the model's climate response to tropospheric aerosols is insensitive to the manner in which the aerosols are vertically distributed.

11602 **Efficient estimation of feedback effects with application to climate models.** Cacuci, D.G.; Hall, M.C.G. (Oak Ridge National Lab., TN). *Journal of the Atmospheric Sciences;* **41**: No. 13, 2063-2068(1 Jul 1984). Contract W-7405-ENG-26.

This work presents an efficient method for calculating the sensitivity of a mathematical model's result to feedback. Feedback is defined in terms of an operator acting on the model's dependent variables. The sensitivity to feedback is defined as a functional derivative, and a method is presented to evaluate this derivative using adjoint functions. Typically, this method allows the individual effect of many different feedbacks to be estimated with a total additional computing time comparable to only one recalculation. The effects on a CO_2-doubling experiment of actually incorporating surface albedo and water vapor feedbacks in a radiative-convective model are compared with sensitivities calculated using adjoint functions. These sensitivities predict the actual effects of feedback with at least the correct sign and order of magnitude. It is anticipated that this method of estimating the effect of feedback will be useful for more complex models where extensive recalculations for each of a variety of different feedbacks is impractical.

11603 **Comparison of wet and dry desiccator test methods for formaldehyde emission from UF-bonded wood products.** Meyer, B.; Koshlap, K.; Geisling, K.L.; Miksch, R.R. (Univ. of Washington, Seattle). *Forest Products Journal;* **33**: No. 1, 35-37(Jan 1983). Contract AC03-76SF00098.

A dry bisulfite-impregnated glass fiber collector was used in the desiccator test for measuring formaldehyde emission from six different commercial wood products. The correlation factor between the wet and dry method is $R^2=0.865$ and confirms the reproducibility of the current collector chemistry. The dry method allows the study of conditioning effects on formaldehyde release.

11604 Long-range atmospheric tracer field test. Fowler, M.M.; Barr, S. (Los Alamos National Lab., NM). *Atmospheric Environment;* **17**: No. 9, 1677-1685(1983).

A long-range application of a heavy methane atmospheric tracer system has been carried out using both $^{12}CD_4$ and $^{13}CD_4$. The experiment had several objectives including testing a newly developed cryogenic air sampler, testing a new sample handling apparatus and demonstrating the use of heavy methanes over transport distances up to 2500 km and travel times of more than 100 h. A simple diffusion estimation method applied in conjunction with trajectories produced by NOAA from upper air meteorological data yields good agreement with the tracer data on dosage and arrival time. The duration of observed tracer at the long-range stations was longer than estimated with simple concepts.

11605 Treatment of ground deposition, species decay and growth and source height effects in a Lagrangian trajectory model. Murphy, B.D.; Nelson, C.B. (Oak Ridge National Lab., TN). *Atmospheric Environment;* **17**: No. 12, 2545-2547(1983). Contract W-7405-ENG-26.

The adaptation of a trajectory model to an initial pollutant species and a series of successor species is discussed. The effect of source height is discussed since it is important in determining close-in ground level concentration, which influences plume depletion due to dry deposition. A scheme is outlined which handles ground deposition together with species decay and growth, and which can treat an arbitrary number of successor pollutant species.

11606 Effects of varying air trajectories on spatial and temporal precipitation chemistry patterns. Raynor, G.S.; Hayes, J.V. (Brookhaven National Lab., Upton, NY). *Water, Air, and Soil Pollution;* **18**: 173-189(1982). Contract AC02-76CH00016.

This study was designed to determine if judicious use of synoptic data and an operational trajectory model could identify probable source regions of anthropogenic pollutants in northeastern US precipitation and thus relate receptor measurements to emissions data without consideration of the complex intervening meteorological and chemical processes. The storm event of April 8 to 10, 1979, was selected for intensive study. Precipitation chemistry data were obtained from event samples at six MAP3S sampling sites and from hourly samples at Brookhaven National Laboratory. Concentrations of hydrogen, sulfate, nitrate and ammonium ions were used as receptor data. Some emissions data for SO/sub x/ and NO/sub x/ were obtained from the MAP3S emissions inventory. Surface and upper air meteorological data were analyzed. Backward trajectories ending at each of the sampling sites during the precipitation period were computed with the Heffter Interactive-Terminal Transport Model using selected transport layers. Results show that concentrations of pollutant species in event precipitation samples were much higher at stations at end points of trajectories passing through the Ohio River valley than at stations with other trajectories. Likewise, concentrations at Brookhaven were much higher during the end period of a trajectory through the same region than with more northerly and more southerly tracks. The model produced back trajectories consistent with synoptic flows. Concentrations of air pollutants in precipitation were roughly proportional to the number of major pollutant sources along the trajectory. These results suggest that a larger number of studies might identify more restricted source areas or even establish a quantitative relationship between source emissions along a trajectory and concentrations in precipitation at receptor sites.

5003 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 50030010970, 10971, 11195, 11205, 11431, 11622

11607 (BNL—51827) 1983 environmental monitoring report. Day, L.E.; Naidu, J.R. (eds.). (Brookhaven National Lab., Upton, NY (USA)). Jun 1984. Contract AC02-76CH00016. 74p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85005651.

The environmental levels of radioactivity and other pollutants found in the vicinity of BNL during 1983 are summarized. The amounts of radioactivity and other pollutants released in airborne and liquid effluents from Laboratory facilities to the environment are also indicated. The environmental data includes external radiation levels; radioactivity of air particulates; tritium concentrations; the amounts and concentrations of radioactivity in and the water quality of the stream into which liquid effluents are released; the concentrations of radioactivity in biota from the stream; the concentrations of radioactivity in and the water quality of ground waters underlying the Laboratory; and concentrations of radioactivity in milk samples obtained in the vicinity of the Laboratory. The amounts of radioactivity released in airborne and liquid effluents from laboratory facilities to the environment were within allowable standards as stipulated in DOE Order 5480.1. Other pollutants, such as metals, organic compounds, etc., in the effluents released from the Laboratory were well below federal, state and local standards as applied to site specific conditions. 34 references, 9 figures, 17 tables.

11608 (CONF-8409169—3) Analysis of uncertainties in CRAC2 calculations: wet deposition and plume rise. Ward, R.C.; Kocher, D.C.; Hicks, B.B.; Hosker, R.P. Jr.; Ku, J.Y.; Rao, K.S. (Oak Ridge National Lab., TN (USA); National Oceanic and Atmospheric Administration, Oak Ridge, TN (USA). Atmospheric Turbulence and Diffusion Lab.). 1984. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005361.

From Society for Risk Analysis annual meeting; Knoxville, TN, USA (30 Sep 1984).

We have studied the sensitivity of results from the CRAC2 computer code, which predicts health impacts from a reactor-accident scenario, to uncertainties in selected meteorological models and parameters. The sources of uncertainty examined include the models for plume rise and wet deposition and the meteorological bin-sampling procedure. An alternative plume-rise model usually had little effect on predicted health impacts. In an alternative wet-deposition model, the scavenging rate depends only on storm type, rather than on rainfall rate and atmospheric stability class as in the CRAC2 model. Use of the alternative wet-deposition model in meteorological bin-sampling runs decreased predicted mean early injuries by as much as a factor of 2 to 3 and, for large release heights and sensible heat rates, decreased mean early fatalities by nearly an order of magnitude. The bin-sampling procedure in CRAC2 was expanded by dividing each rain bin into four bins that depend on rainfall rate. Use of the modified bin structure in conjunction with the CRAC2 wet-deposition model changed all predicted health impacts by less than a factor of 2. 9 references.

11609 (DOE/ER/60095—T3) Source characterization and transport process affecting levels of radon and its decay products in an indoor environment. Final technical report. Wilkening, M.; Schery, S.D. (New Mexico Inst. of Mining and Technology, Socorro (USA)). Jul 1984. Contract AC04-82ER60095. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005421.

The objectives of this study are to determine the effects of pressure variation on diffusion and flow of radon from porous and fractured media; the effects of natural air exchange processes in indoor environments on radon, thoron and their daughter products; radon daughter ion-aerosol interactions, and new instrumentation and methods. The results obtained during this study are discussed. 12 references, 2 tables.

11610 (KFK—3457) Experimental determination of the atmospheric dispersion parameters at the Karlsruhe Nuclear Research Center for 160 m and 195 m emission heights. Pt. 2. Thomas, P.; Nester, K. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Sicherheit; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Nukleare Sicherheit). Aug 1984. 107p. NTIS (US Sales Only), PC A06/MF A01. File Number DE85750296.

Experiments are carried out at the Kernforschungszentrum Karlsruhe in order to determine the atmospheric diffusion of pollutants. The influence on atmospheric diffusion by conditions specific to the site will be investigated. For evaluation of the measurements the diffusion is assumed to be a steady-state process. A two-dimen-

sional Gaussian distribution is used as the theoretical approximation of the concentrations. The dependence of the dispersion parameters sigmasub(y) and sigmasub(z) on the downwind distance is described by a power function. A least squares fit is applied to calculate the horizontal and vertical dispersion parameters and the normalized diffusion factor with the respective errors from the measured wind velocity, emission rate and concentration distribution. The dispersion parameters determined are assigned to stability classes by the measured standard deviation of the vertical wind direction. The reported dispersion parameters are derived from 18 experiments with mostly two sampling periods of 30 min duration each. In 17 experiments two different tracers were released simultaneously at 160 m and 195 m height, in one experiment three different tracers were released. The results of the individual experiments have been combined and smoothed to a set of dispersion parameters for the stability classes A to F. In Part 1 of this report the diffusion experiments are described and the measured data are presented in detail.

11611 **(PNL—4621-Final) Control technology for radioactive emissions to the atmosphere at US Department of Energy facilities.** Moore, E.B. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1984. Contract AC06-76RL01830. 612p. NTIS, PC A99/MF A01; 1; GPO Dep. File Number DE85005817.

The purpose of this report is to provide information to the US Environmental Protection agency (EPA) on existing technology for the control of radionuclide emissions into the air from US Department of Energy (DOE) facilities, and to provide EPA with information on possible additional control technologies that could be used to further reduce these emissions. Included in this report are generic discussions of emission control technologies for particulates, iodine, rare gases, and tritium. Also included are specific discussions of existing emission control technologies at 25 DOE facilities. Potential additional emission control technologies are discussed for 14 of these facilities. The facilities discussed were selected by EPA on the basis of preliminary radiation pathway analyses. 170 references, 131 figures, 104 tables.

11612 **(PNL-SA—11243) Accident-generated radioactive particle source term development for consequence assessment of nuclear fuel cycle facilities.** Sutter, S.L.; Ballinger, M.Y.; Halverson, M.A.; Mishima, J. (Pacific Northwest Lab., Richland, WA (USA)). Apr 1983. Contract AC06-76RL01830. 23p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005526.

Consequences of nuclear fuel cycle facility accidents can be evaluated using aerosol release factors developed at Pacific Northwest Laboratory. These experimentally determined factors are compiled and consequence assessment methods are discussed. Release factors can be used to estimate the fraction of material initially made airborne by postulated accident scenarios. These release fractions in turn can be used in models to estimate downwind contamination levels as required for safety assessments of nuclear fuel cycle facilities. 20 references, 4 tables.

11613 **Widespread after-effects of nuclear war.** Teller, E. (Lawrence Livermore National Lab., CA (USA)). *Nature (London);* **310**: No. 5979, 621-624(23 Aug 1984).

Radioactive fallout and depletion of the ozone layer, once believed catastrophic consequences of nuclear war, are now proved unimportant in comparison to immediate war damage. Today, "nuclear winter" is claimed to have apocalyptic effects. Uncertainties in massive smoke production and in meteorological phenomena give reason to doubt this conclusion.

5006 Regulations

REFER ALSO TO CITATION(S) 50060011189, 11202

11614 **(PB—84-222967) Acid rain and transported air pollutants: implications for public policy.** (Office of Technology Assessment (U.S. Congress), Washington, DC). Jun 1984. 331p. (OTA-O—204). NTIS, PC A15/MF A01.

Library of Congress catalog card No. 84-601073.

Acid rain, ozone, and fine particles in the air are endangering US resources, but controlling these pollutants will be expensive. These air pollutants harm lakes and streams, lower crop yields, damage manmade materials, decrease visibility and pose a threat to forests and human health. The costs to control these pollutants include higher electricity rates, fewer jobs for high-sulfur coal miners and financial strain to utilities and industries. Acid rain and other transported air pollutants pose a special problem for policymakers: how to balance the concerns of those who bear the risk of damage with those who will pay for the control. Scientific uncertainty about many aspects of the problem complicates the decision of whether or when to control. Additional scientific research will not provide an unambiguous answer in the near future, nor will it ever resolve value conflicts. The report synthesizes what is known about pollutant emissions, movements, and effects, and estimates the risk of potential damages to resources. OTA focuses on the public policy implications of the acid rain problems and estimates the costs and potential effectiveness of various control options.

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

5101 Basic Studies

11615 **(DOE/EV/10415—T1) Northern Plant Documentation Center, 1980-1983. Final report.** Murray, D.F. (Alaska Univ., Fairbanks (USA)). [1984]. Contract AT06-80EV10415. 149p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE85006297.

The accomplishments of the Northern Plant Documentation Center, University of Alaska are summarized. In addition to normal curation activities, efforts included continued development of a computerized data bank of information on the Alaskan flora with special attention given to areas which are receiving or are expected to receive impact from energy development projects. An annotated, cross-referenced checklist to vascular plants is also being developed.

11616 **Application of scanning electron microscopy and ultraviolet fluorescence to a study of Chattanooga shale specimens.** Harris, L.A.; Kopp, O.C.; Crouse, R.S. (Oak Ridge National Lab., TN). *Microbeam Analysis;* 465-468(1982). Contract W-7405-ENG-26.

Microanalytical techniques such as SEM, EDX, and EMA have been shown to be ideal in determining the host phases of the minor and trace elements in the Chattanooga shale. Positive correlations were found between pyrite and organic constituents. However, these observations provided no evidence that micro-organisms acted as hosts for pyrite framboids. It is interesting that appreciable organic sulfur is still present, which suggests that the sulfur used for the formation of pyrite must have been derived mostly from other sources. It may be that the sulfate-reducing bacteria had an affinity for organic matter and that the organic fragments acted as substrates for pyrite growth.

5102 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 51020011190, 11195, 11205, 11591, 11607

11617 **(CONF-8411137—1) Areas with forest soils sensitive to acidic deposition under alternative damage hypotheses.** Turner, R.S. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005257.

From National acid precipitation assessment program meeting; Asheville, NC, USA (13 Nov 1984).

This project reviews the potential for acidic deposition to induce changes in forest soils and examines the hypothesized roles of these soil changes in decreased tree growth and forest dieback. Several damage mechanisms will be examined, and maps will be made for each set of hypotheses showing the areal distribution of those soils that could change to a chemical state injurious or less conductive to tree growth. Phase I reviews hypotheses concerning acid deposition effects on soil processes. The hypotheses fall into two categories: (1) changes in soil-plant nutrient relationships; and

(2) changes in the availability of toxic elements to plants. Phase II, the development of criteria for spatially estimating soil and forest effects for each hypothesis selected, will consider numerous environmental factors and depends on availability of data spatially quantifying each factor. The factors examined will depend on the specific hypothesis, but primary reliance will be placed on soil chemical properties, vegetation cover and type, and the properties and amount of deposition. Phase III includes mapping potentially sensitive ecosystems, using computer manipulation of the environmental data identified in Phase II. Boundaries will be drawn based on criteria selected in Phase II for each hypothesis. In Phase IV, selected areas shown on the maps as being sensitive to change or damage by acid deposition will be checked in the field or checked against results of ongling or previous research to assess the validity of the maps. Site assessments will include general observations of condition and dynamics of the ecosystems, tree growth-increment cores, and soil and vegetation sampling for laboratory analyses. 6 references.

11618 **(PNL—5302) Characterization of chemical waste site contamination and its extent using bioassays.** Thomas, J.M.; Callahan, C.A.; Cline, J.F.; Greene, J.C.; McShane, M.C.; Miller, W.E.; Peterson, S.A.; Simpson, J.C.; Skalski, J.R. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1984. Contract AC06-76RL01830. 43p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85005428.

Bioassays were used in a three-phase research project to assess the comparative sensitivity of test organisms to known chemicals, determine if the chemical components in field soil and water samples containing unknown contaminants could be inferred from our laboratory studies using known chemicals, and to investigate kriging (a relatively new statistical mapping technique) and bioassays as methods to define the areal extent of chemical contamination. The algal assay generally was most sensitive to samples of pure chemicals, soil elutriates and water from eight sites with known chemical contamination. Bioassays of nine samples of unknown chemical composition from the Rocky Mountain Arsenal (RMA) site showed that a lettuce seed soil contact phytoassay was most sensitive. In general, our bioassays can be used to broadly identify toxic components of contaminated soil. Nearly pure compounds of insecticides and herbicides were less toxic in the sensitive bioassays than were the counterpart commercial formulations. This finding indicates that chemical analysis alone may fail to correctly rate the severity of environmental toxicity. Finally, we used the lettuce seed phytoassay and kriging techniques in a field study at RMA to demonstrate the feasibility of mapping contamination to aid in cleanup decisions. 25 references, 9 figures, 9 tables.

5103 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 51030010969, 10970, 10971, 10999, 11002, 11195, 11205, 11431, 11607, 11622, 11624, 11635, 11665

11619 **(CONF-841142—2) Field studies on the terrestrial behavior of actinide elements in East Tennessee.** Garten, C.T. Jr.; Bondietti, E.A.; Trabalka, J.R.; Walker, R.L.; Scott, T.G. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 24p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005383.

From Symposium on environmental research for actinide elements; Hilton Head Island, SC, USA (7 Nov 1984).

Field studies on the comparative uptake of various actinide elements (^{232}Th, ^{233}U, ^{238}U, ^{239}Pu, ^{241}Am, and ^{244}Cm) by plants and animals inhabiting historically contaminated environments on the Oak Ridge National Laboratory (ORNL) reservation in East Tennessee are summarized. The present-day pattern of actinide element bioaccumulation from a flood plain site contaminated with Pu in 1944 is U > Th ~ Pu. Thus the environmentally dispersed ^{239}Pu exhibits a transfer from floodplain soil to biota comparable to that of indigenous ^{232}Th and less than that of the indigenous ^{238}U. This ranking agrees with the chemical extractability of U, Th, and Pu from soil, using either weak acids or strongly basic reagents. The pattern of actinide element uptake from the shoreline of a historically contaminated pond is Pu < Am ~ Cm < ^{238}U = ^{233}U. This ranking also agrees with the chemical extractability of Pu, Am, Cm, and U from shoreline sediment, using weak acids. Results from field studies at ORNL agree with what has been generally inferred about the relative food chain transfer of the actinides, based on laboratory studies and field studies at other sites in the United States. Because they share the same valence state, there are apparent strong similarities in soil sorption, plant uptake, and animal uptake between trivalent Am and Cm and between tetravalent Pu and Th. Available evidence suggests that knowledge of the behavior of naturally occurring ^{232}Th in the terrestrial food chain can be useful for predicting the long-term fate of environmentally dispersed ^{239}Pu, while data on ^{238}U might be used to place an upper limit on the expected long-term food chain transfer of all transuranic elements except Np. 33 references, 5 figures, 1 table.

11620 **(EGG—10282-1069) Aerial radiological monitoring survey, Savannah River Plant.** Jobst, J.E.; Boyns, P.K. (EG and G, Inc., Las Vegas, NV (USA). Aerial Measurements Operations). 1984. Contract AC08-83NV10282. 16p. (CONF-841187—24). NTIS, PC A02. File Number DE85004865.

From 5. DOE environmental protection information meeting; Albuquerque, NM, USA (6 Nov 1984).

An aerial radiological survey of the Savannah River Plant was conducted by EG & G for the US Department of Energy. The survey dates were August 2 to August 31, 1982. A survey was also conducted from July through October 1983 to determine the level of man-made isotopes deposited in the Savannah River Floodplain. The survey covered over 8000 line-miles between Augusta and Savannah, Georgia. Airborne measurements were obtained for both natural and man-made gamma radiation of the plant and surrounding areas. These data were used to determine surface terrestrial spatial distributions of isotopes for cobalt-60 and cesium-137. Selected distribution maps for these isotopes are superimposed on site photographs and maps. Detailed cesium-137 contours are presented for Steel Creek. 3 references, 11 figures, 1 table.

11621 **(PNL-SA—11064) Relationship between burial depth and radiocesium and radiostrontium and their accumulation in crop plants.** Cline, J.F.; Schreckhise, R.G.; Cadwell, L.L. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1983. Contract AC06-76RL01830. 17p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005528.

The configurations of ^{137}Cs and ^{85}Sr placed in layers at various depths or mixed throughout the soil profile did not greatly change the nuclide concentrations in the above-ground plant parts grown in pots 50 cm deep and 125 cm in diameter. These findings showed that predictions of radionuclide concentrations in vegetation using soil activity per unit area (μCi/m^2) were less variable than the commonly used concentration ratio (CR) using soil concentrations (μCi/g). The area concentration factors (ACF=μCi/g dry tissue/μCi/m^2 soil surface) for various spiking configurations ranged from 3.0 x 10^{-7} to 2.5 x 10^{-8} for the ^{137}Cs treated soils in the tissues of pea plants. Corresponding CR values varied by factors of 10 to 100 among the various soil configurations. 13 references, 4 figures, 2 tables.

5105 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 51050010879, 10975, 10976, 10977, 10978, 11193, 11194, 11196, 11197, 11198, 11201, 11203, 11206, 11207

11622 **(EGG—10282-1067) Status of the Graphic Overview System in relation to Department of Energy facilities.** Berry, H.A. (EG and G, Inc., Las Vegas, NV (USA). Aerial Measurements Operations). 1984. Contract AC08-83NV10282. 40p. (CONF-841187—25). NTIS, PC A03. File Number DE85004863.

From 5. DOE environmental protection information meeting; Albuquerque, NM, USA (6 Nov 1984).

The Graphic Overview System (GOS) is a compilation of maps, photos, and summary information of environmental programs and related data for Department of Energy (DOE) sites. The information, in the form of colored overlays, consists of environmental monitoring locations, effluent release points, onsite storage locations, NPDES permit locations, aerial survey results, demographic and meteorological data, and other general information. The results

provide a working tool for DOE management and contractors to review and visualize the relationship among environmental programs. In addition, the user can place in proper perspective key aspects of all environmental programs and related information to evaluate the resulting public and environmental impact of the site. Since its inception, the GOS has been expanded to include nonradiological monitoring and site planning and development information. To date, packages for 14 DOE sites have been completed. The package most recently completed, on the Nevada Test Site, contains a considerable amount of historical information. A comprehansive revision and update of the package for the Savannah River Plant is currently in progress. GOS packages serve many functions besides being a tool for reviewing a facility's programs. The packages have been used in court litigation, program planning, public hearings, and both technical and nontechnical briefings and reports. GOS packages also serve as an excellent tool for emergency planning purposes by providing a set of maps and site information and programs on a common scale. 1 table.

11623 **(EGG—10282-1068) Multispectral Remote Sensing at the Savannah River Plant.** Shines, J.E.; Tinney, L.R.; Hawley, D.L. (EG and G, Inc., Las Vegas, NV (USA). Energy Measurements Group). 1984. Contract AC08-83NV10282. 9p. (CONF-841187—26). NTIS, PC A02. File Number DE85004864.

From 5. DOE environmental protection information meeting; Albuquerque, NM, USA (6 Nov 1984).

Aerial Mesurements Operations (AMO) is the remote sensing arm of the Department of Energy (DOE). The purpose of AMO is to provide timely, accurate, and cost-effective remote sensing data on a non-interference basis over DOE facilities located around the country. One of the programs administered by AMO is the Comprehensive Integrated Remote Sensing (CIRS) program, which involves the use of a wide range of data acquisition systems - aerial cameras, multispectral and infrared scanners, and nuclear detectors - to acquire data at DOE sites. The data are then processed, analyzed and interpreted to provide useful information, which is then catalogued into a data base for future use. This report describes some of the data acquisition and analysis capabilities of the Multispectral Remote Sensing Department (MRSD) as they relate to the CIRS program. 3 tables.

11624 **(EGG—10282-1070) Comprehensive, integrated, remote sensing at DOE sites.** Lackey, J.G.; Burson, Z.G. (EG and G, Inc., Las Vegas, NV (USA). Aerial Measurements Operations). 1984. Contract AC08-83NV10282. 10p. (CONF-841187—27). NTIS, PC A02/MF A01; GPO Dep. File Number DE85004867.

From 5. DOE environmental protection information meeting; Albuquerque, NM, USA (6 Nov 1984).

The Department of Energy has established a program called Comprehensive, Integrated Remote Sensing (CIRS). The overall objective is to provide a state-of-the-art data base of remotely sensed data for all users of such information at large DOE sites. The primary types of remote sensing provided consist of the following: (1) large format aerial photography; (2) video from aerial platforms; (3) multispectral scanning; and (4) airborne nuclear radiometric surveys. Implementation of the CIRS Program began with field operations at the Savannah River Plant in 1982 and is continuing at that DOE site at a level of effort of about $1.5 m per year. Integrated remote sensing studies were subsequently extended to the West Valley Demonstration Project in the summer and fall of 1984. It is expected that the Program will eventually be extended to cover all large DOE sites on a continuing basis. 2 figures.

11625 **(ORNL/TM—9326) Characterization of soils at proposed Solid Waste Storage Area (SWSA) 7.** Rothschild, E.R.; Huff, D.D.; Spalding, B.P.; Lee, S.Y.; Clapp, R.B.; Lietzke, D.A.; Stansfield, R.G.; Farrow, N.D.; Farmer, C.D.; Munro, I.L. (Oak Ridge National Lab., TN (USA)). Dec 1984. Contract AC05-84OR21400. 150p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE85004777.

To supplement other waste disposal operations on the DOE Oak Ridge Reservation, the soils at a potential site for shallow land burial of low-level radioactive waste have been characterized. Proposed Solid Waste Storage Area (SWSA) 7 is located in Melton Valley, east of the current burial facilities in the valley. Physical, chemical, and hydraulic properties of the soils on the site are documented. The thin veneer of soil on proposed SWSA 7 has been mapped in detail and divided into 11 mappable units. In general, the upland soils are well drained, whereas the soils in the lower parts of the site may be poorly drained. Six soil types that are most likely to be affected by waste disposal operations were studied in detail. The soils examined contain little or no carbonate and exhibit low pH. Laboratory studies were carried out to determine the moisture characteristic functions for the six soil types. The laboratory data were combined with field data to produce functions that are directly accessible by numerical models to be used for site evaluation in the future. A total of eighteen soil and sediment samples were collected for determination of their radionuclide adsorption properties. Radioisotopes of I, Cs, Sr, Co, and Am were studied, and all exhibited high Kd's (greater than 23 L/kg) with the exception of I, which had a consistently lower Kd. The cation exchange capacities of the soils averaged 169 meq/kg. Three soil profiles were examined in detail and the mineralogy of the horizons determined. Generally, the southern half of the site appears to be dominated by vermiculite-rich micaceous minerals, whereas in the northern half of the site, kaolinite and micaceous minerals dominate. A preliminary evaluation of the potential erosion on this hilly site was made. Once the site is grass covered, the erosion will be on the order of 0.4 to 4.5 metric tons ha^{-1} $year^{-1}$.

11626 **(PNL-SA—11302) Birds of the Hanford site: nest site selection.** Rickard, W.H.; Fitzner, R.E. (Pacific Northwest Lab., Richland, WA (USA)). Mar 1983. Contract AC06-76RL01830. 22p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85006087.

At least 62 species of birds regularly nest on the 1400 km^2 Hanford Site in the semi-arid interior of southcentral Washington. Birds showed nesting preferences for different kinds of vegetation, special natural landscape features and certain kinds of man-made structures. Vegetational nest site preferences were categorized as shrubsteppe, natural coppice, planted trees and cattail-reed marsh. The nonvegetational nest-site preferences were categorized as cliff, rock talus, riverine islands and industrial structures. Natural coppice vegetation was preferred by colorful passerine birds. Planted trees were selected by raptors, crows, ravens, herons and magpies. Shrubsteppe plant communities occupy most of the land area of the Hanford Site; only thirteen species of birds chose to nest in them. Nest-site selection by birds can be used for wildlife mitigation practices associated with the siting, construction and operation of energy related industries on the Hanford Site and in other undeveloped semi-arid regions in the western United States. 22 references, 5 figures, 2 tables.

5106 Regulations

REFER ALSO TO CITATION(S) 51060011189, 11202

11627 **(DOE/FE/60406—T1-Vol.4) Selective permit requirements for natural resource development, land use regulation, environmental quality management, social/ecological preservation, and local regulatory policy. Volume 4. Vermont.** Cox, E.; Veselick, E. (eds.). (Fuel and Mineral Resources, Inc., Reston, VA (USA)). Nov 1983. Contract AC02-83FE60406. 118p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85005082.

This regulatory guide contains Vermont's Land Use and Development Law, and Vermont's Environmental Board Rules. (ACR)

52 ENVIRONMENTAL SCIENCES, AQUATIC

5201 Basic Studies

11628 **How seabirds adapt to ocean processes.** Powers, K.D. (Manomet Bird Observatory, MA). *Oceanus;* **26**: No. 1, 11-17(Spr 1983). Contract AC02-78EV04706.

A general review is presented of the adaptations made by seabirds to their environments. Included in the discussion are behavioral, morphological and physiological adaptation to the ocean environment.

11629 **Simple, inexpensive apparatus for rotating bottles during zooplankton feeding experiments.** McCarthy, J.F. (Oak Ridge National Lab., TN). *Hydrobiologia;* **99**: 151-153(1983). Contract W-7405-ENG-26.

By using the bearing in the hub of bicycle wheels to support the weight of jars containing zooplankton and experiment food, a small laboratory stirring motor can be used to slowly rotate several kilograms of jars for zooplankton feeding experiments. This apparatus is quickly assembled from easily obtainable parts at almost no cost.

11630 **Gastropod shells: a dynamic resource that helps shape benthic community structure.** McLean, R. (Oak Ridge National Lab., TN). *Journal of Experimental Marine Biology and Ecology;* **69**: 151-174(1983). Contract W-7405-ENG-26.

Empty gastropod shells are an important resource for many animals in shallow benthic marine communities. Shells provide shelter for hermit crabs, octopuses, and fishes, provide attachment substratum for hermit crab symbionts, and directly or indirectly modify hermit crab predation. Creation of an empty shell due to predation of one gastropod on another and acquisition of that shell by a hermit crab are two key events in the subsequent use of that shell. Shells of different gastropod species and the species of hermit crab acquiring them affect the symbiont complement that attaches to the shell, which in turn may affect future shell use by other symbionts. Certain shell types worn by the hermit crab, Pagurus pollicaris Say, are positively associated with the symbiotic sea anemone, Calliactis tricolor (Lesueur), which protects the hermit crab from predation by the crab, Calappa flammea (Herbst), and possibly from the octopus, Octopus joubini Robson. Shells of other species of gastropods are resistant to being crushed by the spiny lobster, Panulirus argus (Latreille). The inter- and intraspecific interactions centered on the gastropod shell are termed a "habitat web." The potential of the shell to limit the size and distribution of animal populations demonstrates how this resource helps shape community structure.

5202 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 52020010870, 11195, 11205, 11591, 11607, 11942

11631 **(PB—84-225010) Development of toxic screening models for surface water supplies.** Grayman, W.M.; Goodrich, J.A.; Clark, R.M. (Environmental Protection Agency, Cincinnati, OH (USA). Municipal Environmental Research Lab.). Jul 1984. 9p. (EPA—600/D-84/197). NTIS, PC A02/MF A01.

Prepared in cooperation with Grayman (Walter M.), Cincinnati, OH.

A major interest of the U.S. Environmental Protection Agency has been the assessment or ranking of vulnerable water utilities. Until recently, no techniques have been available, that quantitatively put into perspective the many conflicting factors which contribute to a utility's vulnerability to point and nonpoint sources of pollution. This paper describes a methodology, using two case studies, that enables such analyses and also closes the information gap that potentially exists between water pollution control strategies and water consumption.

11632 **(PNL-SA—12151) Influence of landfills on groundwater quality.** Allen, R.D.; Raymond, J.R. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1984. Contract AC06-76RL01830. 21p. (CONF-8411132—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85004537.

From International conference on ground-water technology; Johannesburg, South Africa (13 Nov 1984).

This paper identifies existing and potential sources of ground water contamination assignable to landfills, discusses factors affecting site selection and qualification, and addresses general procedures for monitoring active and inactive landfills. Waste materials are gradually removed in percolating waters. The thickness and character of unconsolidated deposits beneath a landfill influence the time of waste transport and degree of modification before leachate reaches the water table. For bedrock, both lithology and structure may influence travel time and chemical change of the leachate. Most soils and sediments are chemically active toward dissimilar fluids. Thus, the vadose zone acts as a buffer between landfills and ground water. Chemical activity occurs at surfaces of clay mineral, hydrous oxide and carbonate mineral particles. Silicates are less reactive. Microbial activity may involve indigenous or transported cells. The cation exchange capacity of natural particulates immobilizes some of the leached cations. Solution concentration, pH, and percolation rate affect these reactions. Leachate reaching the water table tends to maintain its chemical integrity with dilution occurring mainly where it contacts the ground water. The leachate moves in the direction of ground water flow as a plume whose shape is determined by the flow characteristics of the aquifer. The velocity tends to be greater at shallow depths. Attenuation of concentration is caused by chemical or biochemical reactions which remove constituents from solution; by dilution; and by adsorption or filtration. The dominating influences of geology, ground water hydrology, surface water hydrology, and climate must be considered in site evaluation. Monitoring of both active and inactive landfills is essential to detect their impacts upon ground water resources. 13 references.

11633 **(PNL-SA—12709) Organics contamination of groundwater: an open literature review.** Steelman, B.L.; Ecker, R.M. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1984. Contract AC06-76RL01830. 13p. (CONF-841187—20). NTIS, PC A02/MF A01; GPO Dep. File Number DE85003601.

From 5. DOE environmental protection information meeting; Albuquerque, NM, USA (6 Nov 1984).

Pacific Northwest Laboratory has conducted an open literature review of organics contamination of groundwater. The purpose of this review is to provide the DOE community with a brief summary of available field data on (1) the most commonly found organics of concern in groundwater, (2) the behavior of organics in groundwater (e.g., transport and transformation mechanisms), and (3) the extent of documented organics migration from the source of contamination. 24 references, 2 tables.

11634 **Parameter constraints in a stream ecosystem model: incorporation of a priori information in Monte Carlo error analysis.** O'Neill, R.V.; Gardner, R.H.; Carney, J.H. (Oak Ridge National Lab., TN). *Ecological Modelling;* **16**: 51-65(1982). Contract W-7405-ENG-26.

Using a model of mass and nutrient dynamics in a stream, the use of a priori information (e.g., mass balance constraints, limits for the state variables, etc.) was evaluated to increase the accuracy and efficiency of Monte Carlo error analysis. The results indicated that a priori information can effectively eliminate physically unrealistic simulations and reduce uncertainty about the predicted values. Some types of a priori information proved more helpful than increased accuracy in measuring model parameters.

5203 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 52030010969, 10970, 10971, 11002, 11195, 11205, 11431, 11607, 11619, 11620, 11622

11635 **(DOE/NV/10045—1) Tritium analysis of the Tatum Salt Dome Area.** Pinson, J.W. (University of Southern Mississippi, Hattiesburg (USA). Dept. of Chemistry). 9 Sep 1979. Contract AS08-79NV10045. 97p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85005477.

Results of tritium analyses of soil, urine and water samples from the Tatum Dome Test Site are presented. (ACR)

11636 **(NUREG/CR—3442) RADTWO: a computer code for simulating fast-transient, two-dimensional, two-layer radionuclide concentration conditions in lakes, reservoirs, rivers, estuaries, and coastal regions.** Eraslan, A.H.; Diament, H.; Codell, R.B. (Oak Ridge National Lab., TN (USA)). Jul 1984. Contract AC05-84OR21400. 416p. (ORNL/TM—8869). NTIS, PC A18/MF A01 - GPO. File Number TI84016513.

RADTWO is a computer code for predicting the transient, two-dimensional transport of radionuclides in receiving water bodies. The model formulation considers two coupled, depth-averaged transport equations for the water layer and the bottom sediment layer. The coupling conditions incorporate bottom deposition and resuspension effects. The computer code uses a discrete-element method that offers variable-size grid cells, accurate shoreline representation, and numerical accuracy. A sample application is provided for the problem of a hypothetical accidental release of radionuclides to a coastal environment. Results are presented as contours of constant radionuclide concentration in the water layer and the bottom sediment layer at various times during the model simulation period. 124 references.

11637 **(PNL—5325) Assembly, operation and disassembly manual for the Battelle Large Volume Water Sampler (BLVWS).** Thomas, V.W.; Campbell, R.M. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1984. Contract AC06-76RL01830. 22p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005170.

Assembly, operation and disassembly of the Battelle Large Volume Water Sampler (BLVWS) are described in detail. Step by step instructions of assembly, general operation and disassembly are provided to allow an operator completely unfamiliar with the sampler to successfully apply the BLVWS to his research sampling needs. The sampler permits concentration of both particulate and dissolved radionuclides from large volumes of ocean and fresh water. The water sample passes through a filtration section for particle removal then through sorption or ion exchange beds where species of interest are removed. The sampler components which contact the water being sampled are constructed of polyvinylchloride (PVC). The sampler has been successfully applied to many sampling needs over the past fifteen years. 9 references, 8 figures.

5205 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 52050010975, 10976, 10977, 10978, 10997, 11000, 11185, 11192, 11200, 11623

5206 Regulations

REFER ALSO TO CITATION(S) 52060011189, 11202

53 ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

5301 Social And Economic Studies

REFER ALSO TO CITATION(S) 53010011219

11638 **(INIS-mf—9138) Public opinion polls on nuclear energy. Analysis of demoscopic findings.** Heller, E.D. (Battelle-Institut e.V., Frankfurt am Main (Germany, F.R.)). Jul 1980. 123p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE85780121.

Future developments in the attitude towards nuclear energy can not be predicted on account of this public opinion survey. The survey shows just how many different factors influence the attitude towards issues of public and political interst. For this reason in particular, it would be desirable to include such aspects into future surveys. The survey shows that public opinion polls quite often investigate on the ordering party's opinion rather than the pollees opinion. The attempt at making public opinion polls a means of forming political opinions, implying a certain desired opinion to be the majority opinion has brought those polls into disrepute. If real results are not required and manipulation prevails, results are prevented, which must not be blamed on the principle of public opinion polls as such.

5303 Environmental Impact Statements

REFER ALSO TO CITATION(S) 53030010943, 10944

11639 **(PB—84-226034) Draft environmental impact statement: proposed oil and gas lease sales 94, 98, and 102 (Gulf of Mexico region).** (Minerals Management Service, Metairie, LA (USA). Gulf of Mexico OCS Regional Office). Aug 1984. 598p. NTIS, PC A25/MF A01.

This EIS is a description of the environmental aspects and impacts of oil and gas activities resulting from these lease sales or the states bordering the Gulf of Mexico. It provides a description of the area, affected environment, and environmental consequences; it discusses the proposed actions, issues and areas of concern, and the major differences of holding these lease sales.

55 BIOMEDICAL SCIENCES, BASIC STUDIES

5501 Behavioral Biology

11640 **Seasonal abundance and habitat use patterns of shorebirds at two sites in northern Alaska.** Myers, J.P.; Pitelka, F.A. (Univ. of California, Berkeley). *Wader Study Group Bulletin;* No. 29, 28-30(Aug 1980).

The data available suggest a massive accumulation of shorebirds spreading east-west along much of the Alaskan coastal plain tundra but restricted to a narrow belt adjacent to the Arctic Ocean. Why this movement occurs is unclear. It may be a response to some seasonal deterioration of feeding conditions in the interior or an improvement along the coast. Alternatively, it may simply be a part of the migration route for different wader species without regard to special stopover conditions along the coast. This raises the question of individual turnover rates for these transients, about which, regretably we have no data. Whatever, the cause, however, it is clear that this corridor has important implications for the commercial development of the region's energy resources: by mid-July and early August virtually the entire annual production of waders on Alsaka's North Slope may be compressed within a very tight belt smack within areas currently undergoing the most intensive development for oil.

5502 Biochemistry

11641 **(IS-T—1184) Applications of NMR to the dynamics of carbohydrates; simplifying NMR spectra of proteins.** Lacelle, S. (Ames Lab., IA (USA)). Jan 1985. Contract W-7405-ENG-82. 178p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE85005268.

Broadline ^{1}H and high resolution ^{13}C solid state nuclear magnetic resonance investigations of the dynamics of α and β cyclodextrins, dextran, and their deuterated analogues in powders are reported. Qualitative spectral density functions are obtained for the kHz range motions from T/sub 1 rho/, T/sub 1d/, and T_2 mesurements. Faster motions were sampled with frequency dependence studies of T_1. From the relative proportions of the relaxation decays and lineshapes, it was possible to correlate these relaxation parameters with different segments of the molecules. Temperature dependence studies of T_1, T/sub 1d/ and the lineshape yielded some energies of activation and a correlation time for relaxation processes in α cyclodextrin. The results of these and other spin dynamics experiments are discussed in light of x-ray crystal and molecular structures. A new approach is proposed for the analysis of chemical shift data of proteins obtained from two-dimensional NMR experiments. Rather than studying the individual shifts of different atoms in a protein, statistical methods are applied to analyze the collection of chemical shifts of the whole molecule. Distribution functions for the spacing between nearest-neighbor energy

levels are presented in the context of random matrix theory. The distribution of energy levels as a function of energy is characterized by a power law dependence. Randomness in a sequence of eigenvalues is also discussed. These methods reduce and classify the large data base of chemical shifts in proteins, which simplify the information content of their spectra. 75 references, 29 figures, 9 tables.

11642 Fluorescence-line-narrowed spectra of polycyclic aromatic carcinogen-DNA adducts. Heisig, V.; Jeffrey, A.M.; McGlade, M.J.; Small, G.J. (Columbia Univ., New York, NY). *Science (Washington, D.C.);* **223**: 289-291(20 Jan 1984). Contract W-7405-ENG-82.

The laser excited fluorescence-line-narrowed spectrum of DNA modified with (+/-)-r-7,t-8-dihydroxy-t-9,10-epoxy-7,8,9,10-tetrahydrobenzo[a]pyrene (BPDE), the ultimate carcinogenic metabolite of benzo[a]pyrene (BP), has been obtained in a water-glycerol-ethanol glass at 4.2 K. The spectrum was well resolved and highly characteristic of the chromophore. Comparisons were made between the spectrum of this modified DNA and the isolated deoxyguanosine-BPDE adduct and a series of other 7,8,9,10tetrahydro-BP (THBP) derivatives. 9-Hydroxy-BP 4,5-oxide, which is also involved in the binding of BP to DNA, and THBP have very similar conventional broadband fluorescence spectra. However, the fluorescence-line-narrowed spectra of their derivatives were readily distinguishable either as individual components or as mixtures.

11643 Crystallization of two cubic forms of soybean trypsin inhibitor E-I, a member of the Bowman-Birk inhibitor family. Wei, C.H. (Oak Ridge National Lab., TN). *Journal of Biological Chemistry;* **258**: No. 15, 9357-9359(10 Aug 1983). Contract W-7405-ENG-26.

The soybean trypsin inhibitor E-I, known to be relatively rich in methionine and cysteine, has been crystallized at room temperature in the presence of polyethylene glycol 4000, sodium chloride, and ammonium sulfate. A pronounced polymorphism in the cyrstals has been observed and two distinctly different cubic forms have been identified. Of the two, one form crystallizes in a unit cell of symmetry F432 with parameters a = b = c = 128.0 A, and diffracts at least to 2.6-A resolution. Each of the 96 asymmetric units contains one protein molecule, and has a solvent content of 60% by volume. The other form is of space group $P4_132$ or $P4_332$ with the unit-cell edge 87.1 A, and diffracts barely to 3-A spacings. The unit cell is composed of 24 asymmetric units, each of which probably also contains one molecule and has a solvent content of 69% by volume. The former cubic form appears to be more suitable for x-ray study than the latter in terms of stability and the extent of diffraction.

11644 Alcohol dehydrogenase and an inactivator from rice seedlings. Shimomura, S.; Beevers, H. (Univ. of California, Santa Cruz). *Plant Physiology;* **71**: 736-741(1983). Contract AC03-76SF00098.

Alcohol dehydrogenase (ADH) was measured in the various organs of rice seedlings (Oryza sativa) growing in air. In extracts from ungerminated seeds, the ADH is stable, but in extracts from seedlings more than 2 days old the enzyme initially present loses activity in a time- and temperature-dependent fashion, due to the presence of an inactivating component which increases with age in roots and shoots. The inactivation can be prevented completely by dithiothreitol, and when this is included in the extraction medium the apparent loss of total ADH in roots and shoots with age is not observed. In seedlings grown in N_2, ADA levels in coleoptile extracts are higher than those in air, the enzyme is stable, and no inactivator can be detected. When seedlings grown for 5 days in air were transferred to N_2 for 3 days, ADA levels increased and there was a decline in inactivator activity. Transfer back to air after 1 day in N_2 led to loss of the accumulated ADH and increase in inactivator. These reciprocal changes and the fact that the inactivator is absent from coleoptiles of seedlings grown in N_2 appear to suggest a regulator role for the inactivator in vivo. However, it is clear that high levels of inactivator and ADH can exist in cells of seedlings grown in air for long periods without loss of enzyme activity, and it is argued that they must normally be separately compartmented.

11645 Alcohol dehydrogenase inactivator from rice seedlings: properties and intracellular location. Shimomura, S.; Beevers, H. (Univ. of California, Santa Cruz). *Plant Physiology;* **71**: 742-746(1983). Contract AC03-76SF00098.

The alcohol dehydrogenase (ADH) inactivator from aerobically grown rice (Oryza sativa) coleoptiles was shown to be associated with membranes which were recovered in sucrose gradients at peak density 1.13 grams per cubic centimeter. When Mg^{2+} was included in the gradient, the inactivator was recovered at peak density 1.16 grams per cubic centimeter coinciding with the marker enzyme for endoplasmic reticulum, antimycin A-insensitive NADH cytochrome c reductase. ADH was recovered exclusively in cytosol fractions. The inactivator attacks ADH from several plant sources and from yeast. There was no evidence for proteolysis when pure yeast ADH was inactivated by the inactivator, but there was a loss of SH groups from ADH during inactivation which was restored after incubation with dithiothreitol under denaturing conditions. The inactivator did not attach other SH enzymes tested but did result in loss of SH groups from glutathione and dithiothreitol which prevent ADH inactivation. When O_2 was removed from the inactivator assay medium, the inactivation as well as the loss of SH groups from yeast ADH was significantly depressed.

5504 Genetics

11646 Relationship between sister-chromatid exchange and perturbations in DNA replication in mutant EM9 and normal CHO cells. Dillehay, L.E.; Thompson, L.H.; Minkler, J.L.; Carrano, A.V. (Lawrence Livermore National Lab., CA). *Mutation Research;* **109**: 283-296(1983). Contract W-7405-ENG-48.

The majority of the high (12-fold elevated) baseline sister-chromatid exchanges (SCEs) that occur in the CHO mutant line EM9 appear to be a consequence of incorporated BrdUrd, and they arise during replication of DNA containing BrdUrd in a template strand. In normal CHO cells the alkaline elution patterns of DNA newly replicated on a BrdUrd-containing template are significantly altered compared with those seen during the replication on an unsubstituted template. The nascent DNA synthesized on such an altered template is delayed in reaching mature size, possibly because replication forks are temporarily blocked at sites occurring randomly along the template. Transient blockage of replication forks may be a prerequisite for SCE. The delay in replication on BrdUrd-substituted templates was greater in EM9 cells than in parental AA8 cells and was also greater in AA8 cells treated with benzamide, an inhibitor of poly(ADPR) polymerase, than in untreated AA8 cells. Under these conditions, treatment with benzamide also produced a 7-fold increase in SCEs in AA8. An EM9-derived revertant line that has a low baseline SCE frequency showed less delay in replication on BrdUrd-substituted templates than did EM9. However, under conditions where the template strand contained CldUrd, which was shown to produce 4-fold more SCEs than BrdUrd in AA8 cells, the replication delay in AA8 was not any greater in the CldUrd-substituted cells. Thus, other factors besides the delay appear to be involved in the production of SCEs by the template lesions resulting from incorporation of the halogen-substituted pyrimidine molecules.

5505 Metabolism

REFER ALSO TO CITATION(S) 55050011688

11647 (INIS-mf—8866) Damage of the hepatic mixed functional oxygenase system by CCl_4. Significance of incorporation of C-14-Cl_4 metabolites in vivo. Fander, U. (Duesseldorf Univ. (Germany, F.R.). Medizinische Fakultaet). 1981. 23p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85780106.

5506 Medicine

11648 (INIS-mf—8857) Experiments for improving the roentgen imaging and thus the caries diagnosis in the approximal space of lateral teeth. Gramm, E. (Wuerzburg Univ. (Germany, F.R.). Medizinische Fakultaet). 20 Jul 1982. 53p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE85780107.

This is a study of possibilities to improve X-ray pictures of the teeth with regard to detail sharpness in the interdental space in a closed row of lateral teeth. For this purpose, X-ray pictures were made of a phantom showing a closed row of lateral teeth, with two different films being used. The row of teeth was made to include two healthy teeth, one tooth with two spots of initial caries, and one tooth with a caries lesion showing already a cavity. The two films used were the usual one, SUPER DOZAHN, and a fine-grain, insensitive film usually chosen for materials testing (NDT 55). The loss in contrast with increasing kV was observed with all X-ray pictures; the insensitive film was in every case more rich in contrast than the usual dental X-ray film. Use of a special paste on the teeth in the interdental space lead to an improved detail sharpness for visual detection. The spots of special interest, i.e. those with initial caries could in no case be clearly defined as such, whereas the caries lesion became evident on all images. The radiation dose was 4,4 times higher when using the insensitive, fine-grain film, as compared to the dental film; use of the paste still increased the radiation dose by a factor of 1.6. The results show that the measures studied in this thesis are not suited to improving the diagnostic value of the X-ray pictures taken as described above.

11649 (INIS-mf—8867) Normal anatomy and aneurysms of middle cerebral artery. A morphological, neuroradiological and clinical study. Yeh, Y.S. (Giessen Univ. (Germany, F.R.). Fachbereich Humanmedizin). 1 Dec 1981. 85p. NTIS (US Sales Only), PC A05/MF A01. File Number DE85780108.

The aim of the present study is to clarify the existing anatomical knowledge and the nomenclature used in describing the normal anatomy of the MCA and its main and cortical branches. The different classifications now available have led to anatomical and terminological confusion and inaccuracy. In this study, it is proposed to make out a new classification and to correlate this with the radiological and operative findings in patients with MCA aneurysms.

11650 (INIS-mf—8868) Value of α-fetoprotein determination in infants and a method of determination by RIA. Roeser, A. (Mainz Univ. (Germany, F.R.). Fachbereich Medizin). 19 May 1982. 137p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85780116.

AFP determinations during pregnancy and for the diagnosis of malignant liver cell carcinomas and teratogenous tumors are usual practice in today's diagnostics. The ready-to-use AFP test kits which are commercially available proved quite easy to handle under practical laboratory conditions and hardly disturbance-prone. However, their users should keep certain error possibilities in mind that are reported in this paper. A small quantity of AFP remains detectable also in the blood of healthy children are older than 2 years. Up to that age, increased concentrations above the later basal value can be normally seen and are mainly age-dependent. Besides the known fields where AFP determination is used, new spheres of indication did not turn up from the investigations on different collectives of patients. However, the determination of AFP levels in children receiving cytostatic treatment showed some interesting aspects. The authors' suggestion to use AFP measurements in the diagnosis of mucoviscidosis were not justified by their results.

11651 (INIS-mf—8869) Aortography following subdiaphragmal aortic biopsy. Evaluation of 94 aortographies for an analysis of biopsy techniques and filling conditions including the peripheral regions. Schimmler, J. (Muenchen Univ. (Germany, F.R.). Fakultaet fuer Medizin). 25 May 1982. 94p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE85780109.

A juxtaposition of the subdiaphragmal and infrarenal translumbar aortic biopsy sites showed decisive advantages in favour of the higher site: a more stable position because of better anatomic fixation and rarer incidence of vascular alterations, a wider vascular lumen. Disadvantages lie in the fact that the large visceral arteries (especially Tr. coeliacus) branch off nearly and in the close anatomic relationship to large abdominal organs and the thoracal region. Evaluation of the radiographical image of the vascular tree after subdiaphragmal aortic biopsy showed an average 82% of the vessels to the area of the Knees to be assessable (renal arteries approximately 93%, popliteal arteries approximately 70%). Beyond, the method proved unsatisfactory: 52% of the vessels could not, or not safety, be evaluated. A relatively broad spectrum of indications by comparison with transfemoral catheter aortography had no influence on the rate of complications with reference to either method. A comparison of the topographic conditions shows the need for even more scrupulous observation of the technique in subdiaphragmal biopsy than in the infrarenal one. To sum up the results obtained, subdiaphregmal translumbar aortography is to be preferred to the infrarenal one where transfemoral catheter aortography is contra-indicated, within the limits mentioned.

11652 (INIS-mf—8870) Value of lymphography in the diagnosis of urological tumors. Fischer, G.E. (Muenchen Univ. (Germany, F.R.). Fakultaet fuer Medizin). 26 May 1981. 47p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE85780110.

Between 1975 and 1979, 204 lymphadenectomies in patients with tumors of the prostate, kidneys, bladder and testicles were carried through following bilateral pedal lymphography. Referred to all organs, the positive and negative initial lymphographic findings were in accordance with the histological ones in about 67%. The more extended the primary tumor, the greater was the consistency of lymphographic and histological findings. This is most obvious in renal adenocarcinomas.

11653 (INIS-mf—8871) Cysts of the semilunar cartilage. Pathogenesis, clinical symptoms and radiology considering also pneumo-arthrographic findings. Bruessermann, M. (Duesseldorf Univ. (Germany, F.R.). Medizinische Fakultaet). 1981. 111p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE85780111.

On the basis of the studies listed in the bibliography, this dissertation reports on the pathology, clinical symptoms and radiology of cysts of the semilunar cartilage. The author analyses 118 cases of his own, with special regard to the results of pneumo-arthrographic investigations carried through according to a special technique by Schaefer. In the course of this work, measurements of the meniscal base are for the first time used as radiological criteria indicating the presence of a cyst of the semilunar cartilage. Furthermore the well-known radiological signs of cysts, such as bone defects according to Albert and Keller, light central spot in the meniscal body, as well as Rauber's sign and horizontal rupture, are investigated as to the frequency of their incidence. For that purpose all the X-ray pictures were subjected to a further dose scrutiny. A list of all the 118 cases with their clinical and radiological data is found in the annex, together with the results of the operations and patho-anatomical investigations.

11654 (INIS-mf—8873) Autoradiographical in-vitro examination of the cell proliferation of persisting psoriatic plaques in preferred areas under therapy with ultraviolet light: Photochemotherapy (PUVA) and selective ultraviolet phototherapy (SUP). Middendorf, M. (Koeln Univ. (Germany, F.R.). Medizinische Fakultaet). 22 Mar 1982. 59p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE85780104.

The application of ultraviolet rays (PUVA, SUP) brought significant progress in the treatment of psoriasis. The goal of UV-irradiation is to normalise the epidermal growth conditions. The cell cycle of persisting psoriatic plaque in preferred areas was examined under therapy with PUVA and SUP using an autoradiographic in-vitro method, double labelling with ^{14}C- and ^{3}H-thymidin. The results were compared to the known cell-kinetic parameters of psoriasis. The values thus obtained confirm the characteristic changes in the cell cycle of psoriasis. Furthermore, there is a block within the DNA-synthesis phase in the plaques persisting

under UV-therapy. The resistence of persisting psoriatic plaques in preferred regions against UV-therapy is regarded as an indication of an extreme disturbance in the proliferation behaviour of the psoriatic skin.

11655 **(INIS-mf—8874) Ultrasonic mammography. Value and meaning of the method in comparison to X-ray mammography, thermography, and fine needle biopsy.** Hueneke, B. (Marburg Univ. (Germany, F.R.). Fachbereich Humanmedizin). 18 Jun 1982. 204p. (In German). NTIS (US Sales Only), PC A10/MF A01. File Number DE85780112.

608 women are examined by means of ultrasonic mammography during the period of 1 year. 432 patients were examined with the compound method with the U.I. Octoson, a water tank scanner, and 176 patients with the real time method with a directly connected linear-array-scanner. The following results were obtained at the end of the examination period: In the ultrasonic and also in the X-ray mammogram tumour diameters can be determined with an error rate of +- 30%. In the diagnosing of carcinomas, a significant dependence of the exactness on the size of the tumour is found for the combination of the five methods tested (clinical examination, X-ray mammography, ultrasonic mammography, thermography, cytology). Classifying the individual methods with regard to their exactness, X-ray mammography ranks in front of ultrasonic mammography. Mastopathic changes in the breast can be screened by means of ultrasonic mammography. The structure of the changes can be determined more exactly than with an X-ray picture which is due to the possibility of differentiating solid and cystic structures. In diagnosing fibro-adenomas and establishing diagnoses on young women with dense gland bodies, ultrasonic mammography is superior to radiology both in the ability of screening a finding of a fibro-adenoma (US=88%, X-ray=75%) and in the possibility of classifying it as "more benign than malignant".

11656 **(INIS-mf—8875) Comparison of arthrography to clinical diagnostics for diagnosing meniscal lesions.** Neuer, H. (Tuebingen Univ. (Germany, F.R.). Medizinische Fakultaet). 1982. 60p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE85780113.

A comparative investigation as to the exactness of clinical and arthrographical diagnostics was carried out on 176 patients who were clinically examined and operated on in the period of 1972-1980. Using solely clinical diagnostics, the total rate of exactness was 90,9%, the exactness regarding the internal meniscal lesion being significantly higher (94.2%) than that regarding external meniscal lesion (76.7%). Using solely arthrographic diagnostics, the total rate of exactness was 82%, the rate for internal meniscus being significantly lower (83.9%) than that obtained using clinical diagnostics. As for the external meniscus, the exactness of arthrography differs only slightly from clinical diagnostics with 74.7%. The most frequent sources of error in arthorgraphy were found to be lesions of the posterior horn at the internal meniscus. In cases of external meniscal lesions, especially when an internal meniscal lesion was existing at the same time, both examination methods failed in 5 cases. For routine diagnosing of meniscal lesions, arthrography is not necessary. An accurate clinical examination and anamnesis bring very good and exact results and should therefore be given absolute priority.

11657 **(INIS-mf—8890) How dangerous are routine X-ray checkups.** Meyer, H.J.; Moser, D.; Schmitz-Feuerhake, I.; Schroeder, P.; Sellmann, L.; Surhoff, J.; Wellner, R. (Bremen Univ. (Germany, F.R.). Sachgebiet Presse- und Informationswesen). Aug 1983. 78p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE85780114.

The central regions of the bronchial tract are highly sensitive to carcinoma caused by radiation of environmental influences. Bronchial carcinomas have one of the highest rates concerning spontaneous occurrence. Risk assessments based on the victims of the atom bomb indicate a proportional relationship between risk and age and the time of the irradiation. A correlation between the radiation-caused risk of lung cancer and the risk caused by cigarette smoking was not proven. The critical article rejects routine X-ray checkups radiography and advocates individual examinations of persons in danger. (DG).

11658 **(INIS-mf—8892) 20. meeting of the Gesellschaft fuer Paediatrische Radiologie. Abstracts.** (Gesellschaft fuer Paediatrische Radiologie, Giessen (Germany, F.R.)). 1983. 74p. (In German). (CONF-8309282—Absts.). NTIS (US Sales Only), PC A04/MF A01. File Number DE85780115.

From 20. meeting of the Gesellschaft fuer Paediatrische Radiologie; Stuttgart, F.R. Germany (30 Sep 1983).

The 54 papers presented at the meeting deal with the methods, reliability and specific problems of paediatric radiology. Sonography is given particular attention. Apart from conventional radiological techniques, also CT and nuclear techniques are reviewed.

11659 **(PB—84-922801/XAB) Neutrons and charged particles in radiotherapy. Oncology overview.** (National Cancer Inst., Bethesda, MD (USA). International Cancer Research Data Bank). Oct 1984. 61p. (NCI/ICRDB/OT—84/01). NTIS, PC $8.00/MF $8.00.

Oncology Overviews are a service of the International Cancer Research Data Bank (ICRDB) Program of the National Cancer Institute, intended to facilitate and promote the exchange of information between cancer scientists by keeping them aware of literature related to their research being published by other laboratories throughout the world. Each Oncology Overview represents a survey of the literature associated with a selected area of cancer research. It contains abstracts of articles which have been selected and organized by researchers associated with the field. Contents: Neutrons and charged particles in radiotherapy of head and neck cancer; Neutrons and charged particles in radiotherapy of central nervous system cancer; Neutrons and charged particles in radiotherapy of digestive cancer; Neutrons and charged particles in radiotherapy of gynecologic cancer; Neutrons and charged particles in radiotherapy of musculoskeletal cancer; Neutrons and charged particles in radiotherapy of other organ site cancer; Neutrons and charged particles in radiotherapy of multiple site cancer; Neutrons and charged particles in radiotherapy--relative biological effectiveness; Neutrons and charged particles in radiotherapy--instrumentation and technology; Neutrons and charged particles in radiotherapy--reviews.

11660 **Preparation of four fluorine-18-labeled estrogens and their selective uptakes in target tissues of immature rats.** Kiesewetter, D.O.; Kilbourn, M.R.; Landvatter, S.W.; Heiman, D.F.; Katzenellenbogen, J.A.; Welch, M.J. (Univ. of Illinois, Urbana). *Journal of Nuclear Medicine;* **25**: No. 11, 1212-1221(Nov 1984). Contract FG02-84ER60218.

Four fluorine-18-labeled estrogens have been prepared by simple displacement reactions utilizing reactive trifluoromethane sulfonate (triflate) precursors and F-18 fluoride ion. All four fluoroestrogens have high affinity for the estrogen receptor. In immature female rats, they are taken up by target tissues, such as the uterus, with very high selectivity: uterus-to-blood ratios at 1 hr are: Compound 1, 39; Compound 2, 12; Compound 3, 13; and Compound 4, 19. That the uptake process involves an estrogen-specific binder of limited capacity is demonstrated by the suppressive effect of coadministered unlabeled estradiol on target tissue uptake.

5507 Microbiology

11661 **(N—84-29438) Methane producing bacteria: immunological characterization. Final Report, 1 April 1981-31 March 1984.** Demacario, E.C.; Macario, A.J.L.; Wolin, M.J. (New York State Dept. of Health, Albany (USA). Div. of Labs. and Research). Mar 1984. 16p. NTIS, PC A02/MF A01.

Methanogenic bacteria, or methanogens, were studied systematically with immunologic techniques. A comprehensive bank of reference antisera was organized from which calibrated antibody probes were generated of high resolution power for rapid bacterial identification and classification, and for examining samples from complex ecosystems. A method was standardized for antigenic fingerprinting methanogens. It was found that these bacteria form an immunologically coherent group, with subgroups of antigenically related members. Antigenic relationships paralleled the phylogenetic organization delineated by comparisons of 165 rRNA nucleotide sequences, and by cell wall chemistry. Immunologic data emerged

as one of the three basic tenets of the notion that methanogens belong in a third primary kingdom, the archaebacteria, evolutionarily different from eubacteria and eukaryotes. The finding, methods and antibodies produced were useful monitoring the bacterial flora of bioreactors. Direct examination of specimens is now possible by simple and specific immunologic procedures, in a few hours.

11662 **Antigenic fingerprinting of methanogenic bacteria with polyclonal antibody probes.** Macario, A.J.L.; Conway de Macario, E. (New York State Dept. of Health, Albany). *System Appl Microbiol;* **4**: 451-458(1983). Contract AC02-81ER10880.

A system is described for constructing a reference chart of antigenic fingerprints of methanogens as a possible guide in identification of new isolates. The chart is easy to use and can accommodate into each fingerprint additional data that will be provided by new antisera, and more fingerprints as other reference bacteria will be studied, without changes in its format or accumulated contents. This ensures a perennial force to the chart as a reference instrument, and allows increase of its resolution power for bacterial identification. Based on this chart, a procedure is described for rapid identification of newly isolated methanogens and comparison of antigenic mosaics expressed on their surfaces. The procedure involves determination of the antigenic fingerprint and tabulation of the data for comparison with those in the chart. The main feature of the fingerprinting method is the use of a panel of antibody probes calibrated to reveal dominant antigens. As the probes reveal the most conspicuous markers in the antigenic mosaic they also delineate the most pronounced antigenic relationships among methanogens. Although the methods reported were developed for study of methanogens with polyclonal antibody probes, they can be applied to any other group of organisms with antigenic mosaics and to studies with panels of monoclonal antibodies.

11663 **New techniques for growing anaerobic bacteria: experiments with Clostridium butyricum and Clostridium acetobutylicum.** Adler, H.I.; Crow, W.D.; Hadden, C.T.; Hall, J.; Machanoff, R. (Oak Ridge National Lab., TN). *Biotechnology and Bioengineering Symposium;* No. 13, 153-161(1983). Contracts W-7405-ENG-26;AS05-76EV04568.

Stable membrane fragments derived from Escherichia coli produce and maintain strict anaerobic conditions when added to liquid or solid bacteriological media. Techniques for growing Clostridium butyricum and Clostridium acetobutylicum in membrane-containing media are described. Liquid cultures initiated by very small inocula can be grown in direct contact with air. In solid media, colonies develop rapidly from individual cells even without incubation in anaerobic jars or similar devices. Observations on growth rates, spontaneous mutations, radiation, and oxygen sensitivity of anaerobic bacteria have been made using these new techniques.

5508 Morphology

11664 **(DOE/EV/10415—2) Development of Northern Plant Documentation Center. Final report.** Murray, D.F. (Alaska Univ., Fairbanks (USA). Inst. of Arctic Biology). [1984]. Contract AT06-80EV10415. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005417.

This progress report summarizes the recent activities of the Northern Plant Documentation Center at the University of Alaska. The herbarium is summarized and efforts to build a computerized data base are described. (MF)

11665 **(PNL—5247) Rooting depth and distributions of deep-rooted plants in the 200 Area control zone of the Hanford Site.** Klepper, E.L.; Gano, K.A.; Cadwell, L.L. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1985. Contract AC06-76RL01830. 23p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005629.

This study was conducted to document rooting depths and distributions of deep-rooted plants common to the Hanford Site 200-Area plateau. The effort concentrated on excavating plant species suspected of having deep root systems, and species that have been reported in previous studies to contain radionuclides in above ground parts. The information obtained in this study will be useful in modeling radionuclide transport by plants and in designing covers and barriers for decommissioning low-level radioactive waste burial sites. Fourteen species including 58 individual plants were excavated to measure maximum rooting depth and root density distribution (g dry root/dm^3) through the root zone. Age and canopy volumes of shrubs were also determined. Eight of the 14 species excavated had average rooting depths of 150 cm or more. The two deepest rooted plants were antelope bitterbrush and sagebrush with average depths of 296 and 200 cm, respectively. Gray rabbitbrush had an average rooting depth of 183 cm. Summer annuals, Russian thistle and bursage, had average rooting depths of 172 and 162 cm, respectively. 7 references, 4 figures, 5 tables.

11666 **Rapid and simple procedure for visualization of amphibian skeletons for teratological studies.** Newman, S.M. Jr.; Dugan, T.S.; Dumont, J.N. (Oak Ridge National Lab., TN). *Transactions of the American Microscopical Society;* **102**: No. 3, 300-305(Jul 1983). Contract W-7405-ENG-26.

A method for Alizarin red S and Alcian blue 8GX double staining of ossified and cartilagenous skeletal components has been developed for late larval and newly metamorphosed stages of Xenopus laevis. This technique, which utilizes fixed specimens, employs hydrogen peroxide bleaching, potassium hydroxide maceration, and ethanol/glycerin clearing, has proved convenient with many possible stopping points and the capability of producing assayable skeletons in only two and one-half days. The method routinely produces stained skeletons with excellent contrast and brilliant colors for photographics. This procedure was developed in conjunction with the use of late larvae of Xenopus as teratological test animals. The sensitivity and uniformity of response of this biological system and the capabilities of this skeletal technique provide an excellent system for the study of teratogenic effects on the development of ossified bone and skeletal conformation.

5509 Pathology

REFER ALSO TO CITATION(S) 55090011649, 11654

5510 Physiological Systems

11667 **Four-urn catenary model for excretion.** Sobel, M.; Bernard, S.R.; Uppuluri, V.R.R.; Nestor, C.W. Jr. (Univ. of California, Santa Barabara). *Bulletin of Mathematical Biology;* **46**: No. 2, 219-227(1984). Contract W-7405-ENG-26.

5530 Agriculture And Food Technology

11668 **(DOE/EV/00637—13) Development of innovative techniques and principles that may be used as models to improve plant performance. Progress report.** Hanna, W.W.; Burton, G.W. (Georgia Univ., Athens (USA). Research Foundation). Jun 1984. Contract AS09-76EV00637. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85004856.

Dominant immunity to rust (Puccinia) and Piricularia leaf spot, a new stable A_1 cytoplasm and yield genes have been discovered in a single accession of P. monodii, a subspecies of pearl millet Pennisetum americanum. The useful genes were transferred to the best pearl millet inbreds using a backcrossing and screening system enhanced by controlling daylength, temperature, and breaking seed dormancy. Genes for fertility restoration, plant morphology, head characteristics and grain yield were transferred from the A′ genome of P. purpureum (secondary gene pool) to pearl millet. This was made possible by doubling the chromosome number of the sterile triploid between pearl millet and P. purpureum to produce fertile hexaploids. A number of hexaploids were backcrossed to pearl millet to find hexaploids that produced A′ gametes to produce AA′ 2n = 14 pearl millet plants. The value of the genes on the A′ genome were not recognized before the AA′ plants were produced because the B genome masked the characteristics on the A′ genome in P. purpureum. In the tertiary gene pool, male and female fertile apomictic BC_1 plants were produced between pearl millet and P.

orientale or P. squamulatum by manipulating chromosome levels or by producing trispecific hybrids. The development of fertile backcross plants in this gene pool is encouraging for further germplasm transfer research with emphasis on apomixis. The cytoplasm of P. schweinfurthii has been transferred to pearl millet. Mutations for early maturity and daylength insensitivity induced with mutagens have resulted in the development and release of early maturing inbreds Tift $23A_1E_1$ and Tift $23B_1E_1$.

11669 **(DOE/R0/01326—T1) [Computerized control of grain drying operations]. Final technical report.** Meyers, N. (Meyers (Nathan), Corvallis, OR (USA)). 31 May 1984. Contract FG06-81R001326. 13p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85004504.

The purpose of this project was to investigate the use of computer tools to reduce the energy requirements of grain drying operations on the farm. While limited to a specific area, the drying of feed corn, this investigation has broader applications in crop and livestock management. The objective was to develop and test a computer-based tool to operate a corn drying bin. Using temperature and humidity sensors, the computer would determine the drying quality of ambient air and add only as much heat as necessary to achieve the minimum necessary drying ability. Feed corn was chosen for the experiment because it is the most thoroughly understood in terms of drying requirements and because of the increasing corn production in the Northwest. 5 references.

11670 **Sampling honeybee colonies for brood production: a double sampling technique.** Rogers, L.E.; Gilbert, R.O.; Burgett, M. (Pacific Northwest Lab., Richland, WA). *Journal of Agricultural Research (Washington, D.C.);* **22**: No. 4, 232-241(1983). Contract AC06-76RL01830.

A procedure is described for estimating numbers of capped brood cells by double sampling combined with linear regression. A complete census of capped brood cells is better than an estimate, provided it is possible to count all brood cells directly or from photographs of brood frames. The double sampling technique, however, has the advantage of enabling data to be collected more quickly and at a lower cost than for a complete count. It also provides an estimate of the approximate variability associated with brood estimates and a mechanism for correcting biases associated with different investigators or with estimates by the same individual at different times or under different conditions. The technique is easy to apply in the field and involves minimal disturbance to the colony. A disadvantage is that the calculations associated with estimates of brood area are more arduous, estimates of variability are approximate, and brood estimates may be biased if the data are too few. All calculations can be easily adapted to a programmable calculator or small computer. Linear calibration, an alternative to the use of double sampling, is briefly discussed.

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

REFER ALSO TO CITATION(S) 56011011686

11671 **(CONF-830782—5) Possible error-prone repair of neoplastic transformation induced by fission-spectrum neutrons.** Hill, C.K.; Han, A.; Elkind, M.M. (Argonne National Lab., IL (USA)). 18 Jul 1983. Contract W-31-109-ENG-38. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005036.

From 11. L. H. Gray conference on cellular repair of radiation damage - mechanisms and modifying agents; Glasgow, UK (18 Jul 1983).

We have examined the effect of fission-spectrum neutrons from the JANUS reactor at Argonne National Laboratory, delivered either as acute or protracted irradiation, on the incidence of neoplastic transformation in the C3H 1OT1/2 mouse embryo cell line. Acute exposures were delivered at 10 to 38 rads/min, protracted exposures at 0.086 or 0.43 rad/min. The total doses for both ranged from 2.4 to 350 rads. In the low dose region (2.4 to 80 rads), there was a large enhancement in transformation frequency when the neutrons were delivered at the low dose rates compared with the high dose rates, but the survival of the cells was not significantly different between the two exposure conditions. Analysis of the initial parts of the curves shows that the regression line for protracted doses is about 9 times steeper than that for single acute exposures. Finally, the possibility is discussed that an error-prone repair process may be causing the enhanced transformation frequency by protracted neutron exposures. 12 references, 2 figures, 1 table.

11672 **(CONF-8410161—3) Distribution of radium and plutonium in human bone.** Schlenker, R.A. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 21p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005025.

From 18. European symposium on calcified tissue; Angers, France (11 Oct 1984).

This paper presents aspects of current and recent work on the distribution of radium and plutonium near the surfaces of human bone and applications of the data. Included are sections on methods, surface deposit thickness, radium distribution near the endosteal surface, the use of alpha spectrometry in conjunction with autoradiography, radium distribution in the mastoid, and factors affecting plutonium specific activity. Emphasis is placed on the alpha spectrometry technique because of its usefulness and its recent application to problems of local dosimetry. 19 references, 14 figures, 6 tables.

11673 **(DOE/EV/10564—T1) Cutaneous melanoma in two populations occupationally exposed to internal deposition of plutonium.** Riches, C.G. (Washington Univ., Seattle (USA)). 1982. Contract AT06-80EV10564. 79p. NTIS, PC A05. File Number DE85005452.

Employees of Lawrence Livermore Laboratory and Richland Operations Office of the US DOE were studied to determine the association between melanoma incidence and plutonium deposition. Numbers of melanomas expected in each group were calculated and compared to the observed incidence rate. 59 references. (ACR)

11674 **(INIS-mf—8888) Studies on irradiated lactate dehydrogenase using gel electrophoresis.** Huth, O. (Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.). Medizinische Fakultaet). 23 Mar 1981. 81p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE85780105.

LDH in aqueous phosphate buffer solution was x-irradiated under nitrogen and dinitrogen oxide. The pre-treated samples were separated by SDS-phosphate gel electrophoresis. Colour yields of the protein bands were determined by planimetry following staining and photometric densitometry. It could be shown that aggregates formed up to the tetramer size were mainly covalently bonded and that negligent amounts of fragments are formed. No exact statements could be made concerning products formed after longer irradiation treatment. Measurements under UV-light also revealed an elevated base from the point of application to the band at the native LDH level; this supports the theory of a reduced migration path through intra-molecular bonding. No firm conclusions can be drawn from the process of staining because CBB itself leads to an increased background colouring between closely-lying protein bands. It could be shown that OH-radicals cause greater changes than H-radicals or solvated electrons since the native LDH peak diminished fastest when irradiated under dinitrogen oxide. With regard to radiation effect it could be demonstrated that a higher radiation dose was required for degradation of the LDH molecule than for its inactivation. These values approach each other with increasing concentration. This indicates that at low concentrations inactivation of the enzyme is mainly caused by conformational changes and at high concentrations by aggregation. Disulphide bridges were found to contribute to aggregate formation in 5-15% of the aggregates formed, this increasing linearly with concentration

11675 **(PB—85-118024/XAB) CSU-FDA (Colorado State Univ.-Food and Drug Administration) Collaborative Radiological Health Laboratory. Annual report - 1982: health effects of prenatal and postnatal whole-body exposure to ionizing radiation in the beagle dog.** Benjamin, S.A. (Colorado State Univ., Fort Collins (USA). Coll. of Veterinary Medicine and Biomedical Sciences). Sep 1984. 80p. NTIS, PC A05/MF A01.

See also PB82-177817. Sponsored in part by National Cancer Inst., Bethesda, MD.

The Collaborative Radiological Health Laboratory was established in 1962 by the U.S. Public Health Service and Colorado State University for the purpose of determining in a carefully controlled animal experiment the life-time hazards associated with prenatal and early postnatal exposure to ionizing radiation. The CRHL study is designed to provide information that will facilitate the evaluation of risks to human beings from medical exposure during early development. The study is a long-term (lifespan) study of a moderately large and long-lived mammal exposed at one of several times during development to a relatively small and discrete dose of external radiation. Ages at irradiation selected for comparison reflect the primary concern with medical exposures during the development period. This annual report summarizes the current status of the study for the reporting period of January 1 through December 31, 1982.

11676 **(UCRL—15644) Chemical protection against ionizing radiation. Final report.** Livesey, J.C.; Reed, D.J.; Adamson, L.F. (Oregon State Univ., Corvallis (USA). Environmental Health Sciences Center). Aug 1984. Contract W-7405-ENG-48. 160p. NTIS, PC A08/MF A01; GPO Dep. File Number DE85006145.

The scientific literature on radiation-protective drugs is reviewed. Emphasis is placed on the mechanisms involved in determining the sensitivity of biological material to ionizing radiation and mechanisms of chemical radioprotection. In Section I, the types of radiation are described and the effects of ionizing radiation on biological systems are reviewed. The effects of ionizing radiation are briefly contrasted with the effects of non-ionizing radiation. Section II reviews the contributions of various natural factors which influence the inherent radiosensitivity of biological systems. Inlcuded in the list of these factors are water, oxygen, thiols, vitamins and antioxidants. Brief attention is given to the model describing competition between oxygen and natural radioprotective substances (principally, thiols) in determining the net cellular radiosensitivity. Several theories of the mechanism(s) of action of radioprotective drugs are described in Section III. These mechanisms include the production of hypoxia, detoxication of radiochemical reactive species, stabilization of the radiobiological target and the enhancement of damage repair processes. Section IV describes the current strategies for the treatment of radiation injury. Likely areas in which fruitful research might be performed are described in Section V. 495 references.

11677 **Application of track calculations to radiobiology. III. Analysis of the molecular beam experiment results.** Zaider, M.; Brenner, D.J. (Columbia Univ., New York, NY). *Radiation Research;* **100**: No. 2, 213-221(Nov 1984). Contract AC02-78EV04733.

Survival data from the molecular beam experiment are used to obtain an estimate of the function $\gamma(x)$ describing the probability for two energy transfers a distance x apart to produce a lesion. A comparison is made between the functions $\gamma(x)$ obtained using proximity functions calculated with Monte Carlo-generated tracks and with simplifying assumptions (the LET approximation). The results differ substantially, which shows that the results are very sensitive to the degree of detail used in characterizing the physics of the irradiating field.

11678 **Subchromosomal DNA synthesis in synchronous V-79 Chinese hamster cells after x irradiation.** Meechan, P.J.; Carpenter, J.G.; Griffiths, T.D. (Univ. of Rochester School of Medicine, NY). *Radiation Research;* **100**: No. 2, 273-281(Nov 1984). Contract AC02-76EV03490.

A substantial fraction of replicon initiation events in Chinese hamster V-79 cells have been shown to be refractory to the effects of X irradiation immediately after exposure. This study examines the possibility that the initiation radiorefractive portion is the result of changes in replicon radiosensitivity as a function of position in S phase. The data obtained from DNA fiber autoradiograms and kinetic incorporation of radiolabeled thymidine from cells irradiated at various position in S phase showed only slight changes in the proportion of replicons refractive to X irradiation immediately after exposure. These results indicate that initiation radiorefractive replicons may be an intrinsic property of V-79 cells and that cell-cycle-specific heterogeneity in radiation response cannot fully account for this phenomenon. The results also indicate that delayed inhibition of initiation events may play a larger role in the observed radiorefractive fraction than previously thougnt.

11679 **Delayed inhibition of subchromosomal DNA synthesis in V-79 Chinese hamster cells after γ irradiation.** Meechan, P.J.; Griffiths, T.D. (Univ. of Rochester School of Medicine, NY). *Radiation Research;* **100**: No. 2, 282-289(Nov 1984).

Existence of a substantial fraction of replicon initiation events refractory to the effects of X irradiation in Chinese hamster cells has been reported by several laboratories. The work reported here examined whether this apparently refractive fraction resulted from a delayed inhibition of initiation events. Data obtained from velocity sedimentation studies indicated that the extent of inhibition increased over the first hour after irradiation from 35% inhibition immediately following exposure to 3 kR to 75% inhibition of initiation 1 hr after irradiation. Analysis of subsequent recovery of initiation radiosensitivity was performed using DNA fiber autoradiograms prepared from cells incubated up to 4 hr between 2-kR exposures. The data from these experiments indicated that some recovery occurs within 1 hr of irradiation and thus separation of the inhibition and recovery processes in V-79 cells may not be feasible.

11680 **Survival of mammary epithelial cells from virgin female BALB/c mice following in vivo gamma irradiation.** Adams, L.M.; Ethier, S.P.; Ullrich, R.L. (Oak Ridge National Lab., TN). *Radiation Research;* **100**: No. 2, 264-272(Nov 1984). Contract W-7405-ENG-26.

To examine the cytotoxic effects of ionizing radiation on mouse mammary epithelial cells, a transplantation assay was used to generate a single-dose survival curve. In these experiments, virgin female BALB/c mice were irradiated with 0, 100, 300, 600, 900, 1200, or 1500 rad whole-body ^{137}Cs radiation. Mammary glands of control and irradiated mice were removed and the mammary epithelial cells were enzymatically dissociated, either immediately or 24 hr following irradiation, serially diluted, and injected into gland-free mammary fat pads of 3 1/2-week-old virgin female BALB/c host mice. The number of cells required to give ductal growth at 10 weeks in half the fat pads (the mammary cell dose 50%, MCD_{50}) was determined by a maximum likelihood procedure and the ratio of MCD_{50} for nonirradiated control cells to MCD_{50} for irradiated cells provided an estimate of cell survival. Fitting the data using a single hit multitarget model resulted in an estimate for D_0 of 250 rad with an n of 2.4. No significant difference in the results was obtained whether the cells were dissociated and transplanted immediately after irradiation or the cells were allowed to remain in situ for 24 hr following irradiation. Thus no in situ repair was detected for mouse mammary epithelial cells.

11681 **Relative biological effectiveness measurements using murine lethality and survival of intestinal and hematopoietic stem cells after Fermilab neutrons compared to JANUS reactor neutrons and ^{60}Co gamma rays.** Hanson, W.R.; Crouse, D.A.; Fry, R.J.M.; Ainsworth, E.J. (Argonne National Lab., IL). *Radiation Research;* **100**: No. 2, 290-297(Nov 1984). Contract W-7405-ENG-26.

The relative biological effectiveness (RBE) of the 25-MeV (average energy) neutron beam at the Fermi National Accelerator Laboratory was measured using murine bone marrow (LD/sub 50/30/) and gut (LD/sub 50/6/) lethality and killing of hematopoietic colony forming units (CFU-S) or intestinal clonogenic cells (ICC). The LD/sub 50/30/ and LD/sub 50/6/ for mice exposed to the Fermilab neutron beam were 6.6 and 8.7 Gy, respectively, intermediate between those of JANUS neutrons and ^{60}Co γ rays. The D_0

values for CFU-S and ICC were 47 cGy and 1.05 Gy, respectively, also intermediate between the lowest values found for JANUS neutrons and the highest values found after ^{60}Co γ rays. The split-dose survival ratios for CFU-S at intervals of 1-6 hr between doses were essentially 1.0 for both neutron sources. The 3-hr split-dose survival ratios for ICC were 1.0 for JANUS neutrons, 1.85 for Fermilab neutrons, and 6.5 for ^{60}Co γ rays. The RBE estimates for LD/sub 50/30/ were 1.5 and 2.3 for Fermilab and JANUS neutrons, respectively. Based on LD/sub 50/6/, the RBEs were 1.9 (Fermilab) and 3.0 (JANUS). The RBEs for CFU-S D_0 were 1.4 (Fermilab) and 1.9 (JANUS) and for jejunal microcolony D_0 1.4 (Fermilab) and 2.8 (JANUS).

11682 Alternative interpretations of statistics on health effects of low-level radiation. Hamilton, L.D. (Brookhaven National Lab., Upton, NY). *American Statistician;* **37**: No. 4, 442-456(Nov 1983). Contract AC02-76CH00016.

Four examples of the interpretation of statistics of data on low-level radiation are reviewed: (a) genetic effects of the atomic bombs at Hiroshima and Nagasaki, (b) cancer at Rocky Flats, (c) childhood leukemia and fallout in Utah, and (d) cancer among workers at the Portsmouth Naval Shipyard. Aggregation of data, adjustment for age, and other problems related to the determination of health effects of low-level radiation are discussed. Troublesome issues related to post hoc analysis are considered.

11683 No liquid holding recovery for chromosomal aberrations or sister-chromatid exchanges in irradiated G_1 human lymphocytes. Kale, R.; Bender, M.A. (Brookhaven National Lab., Upton, NY (USA). Medical Dept.). *Mutation Research;* **122**: No. 1, 53-58(Oct 1983).

CODEN: MUREA.

We have tested G_0 phase human peripheral lymphocytes for liquid holding recovery (LHR) mediated decreases in X-ray-induced chromosomal aberration yields and increases in sister-chromatid exchange (SCE) levels such as have been demonstrated for confluency-inhibited mouse cells in culture (Nagasawa and Little, 1981). No influence on either aberration yields or SCE levels was demonstrated. However, an effect at least superficially similar to the LHR effect was seen for rings and dicentrics, but not for deletions or SCE in lymphocytes in transition between G_0 and G_1 following PHA stimulation.

11684 Role of the supX gene in sensitizing Salmonella typhimurium cells to respiration shutoff induced by far ultraviolet irradiation. Swenson, P.A.; Riester, L.; Palmer, T.V. (Oak Ridge National Lab., TN). *Photochemistry and Photobiology;* **8**: No. 3, 305-310(1983). Contract W-7405-ENG-26.

Salmonella typhimurium strains with supX mutations are known to be sensitive to ultraviolet (254 nm) irradiation (UV) and to be protected by plasmid pKM101. Wild type (sup X/sup bonds/) cells shut off their respiration after UV and are protected against their shutoff by pKM101. Respiration and survival studies were carried out on seversl supX strains with different genetic backgrounds. The supX strains shut off their respiration after low fluences of UV. Plasmid pKM101 protected a supX83 (nonsense mutation) strain against respiration shutoff and killing but did not protect a supX35 (deletion mutation) strain against respiration shutoff or killing. When each of the two supX genes were in the genetic backgrounds of the other, however, full protection was provided by pKM101. The supX35 strain not protected by pKM101 may have accumulated a modifying mutation. The supX locus is identical with one specifying topoisomerase I which removes negative superhelical turns from DNA. In the absence of this enzyme transcription of the DNA is increased. It is proposed that the exaggerated shutoff of respiration and increased killing of supX cells occurs because of the greater ease of transcription of an operon involved in UV-induced respiration shutoff.

11685 Inducible excision repair in Escherichia coli. Cooper, P.K. (Stanford Univ., CA). pp 139-146 of Chromosome damage and repair. Seeberg, E.; Kleppe, K. (eds.). New York, NY, USA; Plenum Publishing Corporation (1981). Contract AM03-76SF00326.

5603 Chemicals Metabolism And Toxicity

REFER ALSO TO CITATION(S) 56030010886, 10886, 10887, 10887, 10887, 10887, 10933, 10939, 10942, 10942, 11618, 11646, 11647, 11666

11686 (DOE/EV/02217—51) Mechanisms of photosensitization by furocoumarins. Grossweiner, L.I. (Illinois Inst. of Tech., Chicago (USA). Dept. of Physics). 1982. Contract AC02-76EV02217. 28p. (CONF-8203198—1). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85004289.

From Conference on photobiologic, toxicologic, and pharmacologic aspects of psoralens; Research Triangle Park, NC, USA (1 Mar 1982).

Furocoumarins photosensitize biomolecules to UVA by way of Type I (sensitizer-substrate) and Type II (sensitizer-oxygen) mechanisms. The Type I reactions with DNA are mediated by ground state complexes. Covalent monoadducts of the furocoumarin with pyrimidines are formed in the first photochemical step. A fraction of the monoadducts of difunctional furocoumarins are converted to interstrand cross-links in a second photochemical step, as controlled by the type of monoadduct site and the spectral distribution of the radiation. Certain furocoumarins generate singlet molecular oxygen by energy transfer from the furocoumarin triplet state. The photosensitized inactivation of enzymes involves a Type II mechanism mediated by singlet oxygen. Singlet oxygen reacts with 8-methoxypsoralen to form long-lived products, which have been implicated in the formation of covalent photoconjugates with serum albumin and other proteins and peroxidation of unsaturated lipids. The available information about furocoumarin photosensitized inactivation of microorganisms indicates that DNA monoadducts are removed by an efficient excision repair process and DNA cross-links are removed by a more complex, error-prone process, both of which are under genetic control. The significantly higher sensitivity of microorganisms to difunctional furocoumarins has been identified with the formation of cross-links. Both monoadducts and cross-links induce mutations in microorganisms, with a strong dependence on the specific furocoumarin structure, the strain, and the type of mutation. 62 references, 5 tables.

11687 (ORNL/TM—9403) Inhalation toxicology of diesel fuel obscurant aerosol in Sprague-Dawley rats. Final report, Phase 3, subchronic exposures. Lock, S.; Dalbey, W.; Schmoyer, R.; Griesemer, R. (Oak Ridge National Lab., TN (USA)). Dec 1984. Contract AC05-84OR21400. 84p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85005336.

Inhalation exposures were performed twice per week, for 13 weeks, to determine whether there was any potential toxicity to rats of comparatively low concentrations of a condensation aerosol from diesel fuel. Changes in breathing frequency and the response of animals to a loud sharp sound (startle response) were measured in selected animals prior to the start of the exposures, at various time points during the thirteen week exposure period, and at monthly intervals during the recovery period. Assays were performed on selected animals at the end of the exposure period, and again after the two month recovery period. Endpoints included pulmonary function tests, numbers of alveolar free cells, clinical chemistry, hematology, organ weights and histopathology. No mortalities were recorded during the exposure or recovery periods. Slight toxicity occurred at these low aerosol concentrations with the loss in body weight of all treated animals during the exposure period. During the exposure period there were also some slight changes in startle reflex, however, these were apparently acute effects, and there appeared to be no permanent CNS involvement as measured by this endpoint. Immediately post-exposure, the numbers of lavaged alveolar macrophages were slightly elevated in all aerosol exposed animals. Pulmonary function tests, pulmonary gas exchange and dynamic lung tests were all apparently unaffected by these low diesel fuel aerosol exposures. Changes in tissue weights in aerosol exposed animals were minor and the few histopathological lesions were randomly scattered amongst all groups included in this study and were more attributable to the age of the animals than any specific treatment group. No significant cumulative toxicity may be attributed to these diesel fuel aerosol exposures. 14 references, 1 figure, 42 tables.

11688 Lund clearance of neutron-activated Mount St. Helens volanic ash in the rat. Wehner, A.P.; Wilerson, C.L.; Stevens, D.L. (Battelle Pacific Northwest Lab., Richland, WA). *Environmental Research;* **35**: No. 1, 211-217(Oct 1984).

To determine pulmonary deposition and clearance of inhaled volcanic ash, rats received a single 60-min, nose-only exposure to neutron-activated ash. Over a period of 128 days after exposure, the rats were sacrificed in groups of five animals. Lungs were analyzed for the radionuclide tracers ^{46}Sc, ^{59}Fe, and ^{60}Co by γ-ray spectrometry. The alveolar ash burdens, detemined by the radionuclides ^{46}Sc and ^{59}Fe, are in good agreement for the majority of samples analyzed, indicating ash particulate levels in the lungs, rather than leached radionuclides. The ash deposition estimates based on ^{60}Co were appreciably lower for the lungs, indicating that ^{60}Co leached from the ash. Approximately 110 μg ash, or 6% of the inhaled ash, was initially retained in the deep lung. The biological half-time of the alveolar ash burden was 39 days. After 90 days, the mean lung burden had decreased to about 20% of its initial value; 128 days after exposure, about 10% remained.

11689 Inducible reactivation of bacteriophage T7 damaged by methyl methanesulfonate or UV light. Dodson, L.A.; Masker, W.E. (Univ. of Tennessee, Oak Ridge). *Journal of Bacteriology;* **156**: No. 1, 13-18(Oct 1983). Contract W-7405-ENG-26.

An examination was made of the effects of host mutations affecting "SOS"-mediated UV light reactivation on the survival of bacteriophage T7 damaged by UV light or methyl methanesulfonate (MMS). Survival of T7 alkylated with MMS was not affected by the presence of plasmid pKM101 or by a umuC mutation in the host. The survival of UV light-irradiated T7 was similar in $umuC^+$ and umuC strains but was slightly enhanced by the presence of pKM101. When phage survival was determined on host cells preirradiated with a single inducing dose of UV light, these same strains permitted higher survival than that seen with noninduced cells for both UV light- and MMS-damaged phage. The extent of T7 reactivation was approximately proportional to the UV light inducing dose inflicted upon each bacterial strain and was dependent upon phage DNA damage. Enhanced survival of T7 after exposure to UV light or MMS was also observed after thermal induction of a dnaB mutant. Thus, lethal lesions introduced by UV light or MMS are apparently repaired more efficiently when host cells are induced for the SOS cascade, and this inducible reactivation of T7 is $umuC^+$ independent.

11690 Acidic precipitation effects on crops: a review and analysis of research. Irving, P.M. (Argonne National Lab., IL). *Journal of Environmental Quality;* **12**: No. 4, 442-453(Oct-Dec 1983).

For more than a century it has been known that vegetative growth is affected by the products of fossil fuel combustion. Recently, the acidic deposition phenomenon has gained increasing attention, especially when implicated as a factor responsible for economic loss. Research has been directed toward quantification of effects; however, limitations in the design of many crop studies restricts the usefulness and applicability of the results. Acidic deposition varies in a number of ways that may affect crop yield (i.e., level of acidity, amount and intensity of rain, S and N doses.) The responses to these variables may be nonlinear. To allow comparisons of published acid precipitation effects research, calculations for this review were made (based on information in the literature or from personal communication) to describe the experimental conditions, the various dose parameters, and the responses in comparable units for each investigation. The majority of crop species studied in field and controlled environment experiments exhibited no effect on growth nor yield as a result of simulated acidic rain. The growth and yield of some crops, however, was negatively affected by acidic rain; others exhibited a positive response. This analysis of the current literature concludes that the effects of acidic precipitation on crops appear to be minimal and that when responses are observed, they may be positive or negative. More complex experimental designs and analyses may be necessary in order to examine and describe the possible subtle responses of agricultural systems to acidic precipitation.

11691 Analysis of a mouse α-globin gene mutation induced by ethylnitrosourea. Popp, R.A.; Bailiff, E.G.; Skow, L.C.; Johnson, F.M.; Lewis, S.E. (Oak Ridge National Lab., TN). *Genetics;* **105**: 157-167(Sep 1983). Contract W-7405-ENG-26.

A DBA/2 mouse treated with ethylnitrosourea sired an offspring whose hemoglobin showed an extra band following starch gel electrophoresis. The variant hemoglobin migrated to a more cathodal posititon in starch gel. Isoelectric focusing indicated that chain 5 of the mutant hemoglobin migrated to a more cathodal position than the normal chain 5 from DBA/2 mice and that the other α-globin, chain 1, was not affected. On focusing gels the phenotype of the mutant allele, Hba/sup y9/, was expressed without dominance to normal chain 5, and Hba/sup y9/ / Hba/sup y9/ homozygotes were fully viable in the laboratory. The molecular basis for the germinal mutation was investigated by analyzing the amino acid sequence of chain 5/sup y9/, the mutant form of α-chain 5. A single amino acid substitution (His → Leu) at position 89 was found in chain 5/sup y9/. The authors propose that ethylnitrosourea induced an A → T transversion in the histidine codon at position 89 (CAC → CTC). This mutation has apparently not been observed previously in humans, mice or other mammals, and its novel occurrence may be indicative of other unusual mutational events that do not ordinarily occur in the absence of specific mutagen exposure.

11692 Rapid changes in deoxynucleoside triphosphate pools in mammalian cells treated with mutagens. Das, S.K.; Benditt, E.P.; Loeb, L.A. (Univ. of Washington, Seattle). *Biochemical and Biophysical Research Communications;* **114**: No. 2, 458-464(29 Jul 1983).

The rapid increase in cellular deoxynucleoside triphosphate (dNTP) concentrations in Chinese Hamster cell line V79 after exposure to known mutagens is described. With this cell line an expansion of dATP and dTTP pools was detected; changes in dCTP were not large; changes in dGTP were either not significant or too low to quantitate. This situation may reflect the existence of imbalances in dNTP pools at the DNA replication fork. The expansion of dATP and dTTP pools occurred within 2 to 4 hours after exposure of cultured cells to N-methyl-N'-nitro-N-nitrosoguanidine (MNNG). Ultraviolet light (UV), mitomycin C, and cytosine arabinoside also caused similar dNTP pool changes.

11693 Potentiating effects of oxygen in lungs damaged by methylcyclopentadienyl manganese tricarbonyl, cadmium chloride, oleic acid, and antitumor drugs. Hakkinen, P.J.; Morse, C.C.; Martin, F.M.; Dalbey, W.E.; Haschek, W.M.; Witschi, H.R. (Univ. of Tennessee, Oak Ridge). *Toxicology and Applied Pharmacology;* **67**: 55-69(1983). Contract W-7405-ENG-26.

The intraperitoneal administration of methylcyclopentadienyl manganese tricarbonyl (MMT) and cyclophosphamide, exposure to an aerosol of cadmium chloride, intravenous administration of oleic acid, and intratracheal instillation of bleomycin to young female BALB/c mice or CD/CR rats result in acute lung injury. Pulmonary morphology and lung collagen content were examined in animals treated with these chemicals alone or in combination with an elevated oxygen concentration (80%) in the inspired air. In mice, the development of fibrosis could be significantly enhanced if animals treated with MMT, cadmium chloride, cyclophosphamide, or bleomycin were exposed to 80% oxygen immediately following exposure to these agents. In rats only cyclophosphamide- and bleomycin-induced acute lung injury was potentiated by hyperoxia, resulting in significant enhancement of lung collagen content. The pathogenesis responsible for this differential species response of pulmonary injury to hyperoxia remains to be investigated.

11694 Transformation of Syrian hamster embryo cells by synfuel mixtures. Frazier, M.E.; Andrews, T.K. Jr. (Pacific Northwest Lab., Richland, WA). *Journal of Toxicology and Environmental Health;* **11**: 591-606(1983). Contract AC06-76RL01830.

Existing Syrian hamster embryo (SHE) cell-transformation assay methods were modified to allow the assay of complex synfuel mixtures. A shale oil, high-molecular-weight, high-boiling distillates from two different solvent-refined coal (SRC) processes, and two

crude petroleum samples caused transformation of SHE cells. Chemical fractionation of SRC-11 heavy distillate and assay of resultant fractions allowed detection of significant transforming activity in chemical fractions, where such activity had not previously been observed. The polyaromatic-hydrocarbon-enriched fraction, neutral aliphatic hydrocarbon fraction, and neutral tar fraction all showed a positive response in the SHE assay. Earlier data was confirmed showing that both the tar fractions (basic and neutral) and the soluble basic fractions from both SRC processes and shale oil contained genetically active materials.

11695 **Ammonia regulation of intermediary metabolism in photosynthesizing and respiring Chlorella pyrenoidosa: comparative effects of methylamine.** Kanazawa, T.; Distefano, M.; Bassham, J.A. (Sagami Woman's College, Sagamihava, Japan). *Plant and Cell Physiology (Tokyo);* **24**: No. 6, 979-986(1983). Contract AC03-76SF00098.

Methylamine added to the medium of the unicellular alga Chlorella pyrenoidosa causes most of the shifts in carbon metabolism previously observed with ammonia addition. The most prominent and reproducible effect seen is a greatly increased flow of carbon from triose phosphates into alanine, aspartate, and glutamate, and acids of the tricarboxylic acid cycle including malate, fumarate, and citrate. The large increase in synthesis of glutamine seen with ammmonia addition does not occur with methylamine addition. It is concluded that accelerated glutamine synthesis per se is not the primary cause of the other regulatory shifts in carbon metabolism seen with ammonia (and now with methylamine) as has been proposed earlier. Stimulation of phosphoenolpyruvate carboxylase by methylamine supports a previous proposal that the activity of this enzyme increases with a small rise in cytoplasmic pH resulting from entry of ammonia into the cytoplasm. Increases in the activity of pyruvate kinase and the rate of oxidation of triose phosphate remain unexplained. If these changes are due to change in ATP/ADP ration, the cause for the change in this ratio must be found elsewhere than in a stimulation of the rate of glutamine synthesis.

11696 **Effects of O_2 concentration on rice seedlings.** Alpi, A.; Beevers, H. (Univ. of California, Santa Cruz). *Plant Physiology;* **71**: 30-34(1983). Contract AC03-76SF00098.

The ability of rice, wheat, and oat seedlings to germinate and grow as the O_2 concentration was lowered to zero was compared. The germination of rice was completely unaffected by O_2 supply, whereas that of oats and wheat was strongly retarded at levels below 5% O_2. In contrast to the coleoptiles of oats and wheat and to roots of all three species where growth was progressively diminished as the O_2 concentration was lowered, that of the rice coleoptile was progressively increased. However, the dry weight and content of protein, sugars, and cellulose were all depressed in the rice coleoptile in anoxia, and the levels of several respiratory enzymes, particularly those of mitochondria, were also much lower than those of the coleoptiles grown in air. In 1% O_2, the growth of the rice coleoptile was similar to that in air. The effect of ethanol concentration on germination and growth of rice was measured. Coleoptile growth was reduced when the ethanol concentration exceeded 40 millimolarity, and root growth was somewhat more sensitive. Coleoptiles of all three species grown in air were transferred to N_2 and ethanol accumulation was measured over 24 hours. The rate of ethanol accumulation in oats was close to that in rice, and in all three species the amounts of ethanol lost to the surrounding medium were those expected from simple diffusion from the tissue. The ability of the rice coleoptile to grow in anoxia is apparently not due to a particularly low rate of ethanol formation or to unusual ethanol tolerance. Any explanation of the success of rice in anoxia must encompass the much lower rate of ATP synthesis than that in air and account for the biochemical deficiencies of the coleoptile.

11697 **Cytotoxicity and mutagenicity of vapor-phase pollutants in rat lung epithelial cells and Chinese hamster ovary cells grown on collagen gels.** Zamora, P.O.; Benson, J.M.; Marshall, T.C.; Mokler, B.V.; Li, A.P.; Dahl, A.R.; Brooks, A.L.; McClellan, R.O. (Lovelace Biomedial and Environmental Research Inst., Albuquerque, NM). *Journal of Toxicology and Environmental Health;* **12**: 27-38(1983). Contract AC04-76EV01013.

Lung epithelial cell (cell line designated LEC) and Chinese hamster ovary (CHO) cells were grown on hydrated collagen gels and exposed directly to toxic vapor-phase pollutants. The cells were exposed to graded concentrations of phenol, formaldehyde, a volatile fraction of process stream material from an experimental coal gasifier, and the nonparticulate, vapor phase of diesel engine exhaust. During exposures, the cells were maintained at an air/collagen interface by removing the medium overlying the hydrated collagen gel. Morphological changes indicative of cell retraction were found in LEC cell cultures exposed to phenol, formaldehyde, or diesel exhaust. Damage following exposure to the toxicants was quantitated in LEC and CHO cells by Trypan blue dye exclusion, a measure of plasma membrane integrity. Clone-forming ability was also used to measure cell survival in CHO cells. When measured by Trypan blue dye exclusion, phenol (EC50 = 2.1 mg/l) caused membrane damage to LEC cells but not CHO cells, while formaldehyde (EC50 = 31 and 42 μg/l for LEC and CHO, respectively) and diesel exhaust (EC50 = 11 and 29% of tailpipe exhaust in LEC and CHO cells, respectively) caused damage to both cell types. No cytotoxicity was observed in LEC or CHO cells exposed to the fraction from the coal gasifier. Essentially no mutagenic activity was associated with the exposure of CHO cells to formaldehyde or the vapor phase of diesel exhaust. Mutagenic activity was found in CHO cells exposed to ethylene oxide, the positive control.

11698 **Lack of induction of single-strand breaks in mammalian cells by sodium azide and its proximal mutagen.** Arenaz, P.; Nilan, R.A.; Kleinhofs, A. (Washington State Univ., Pullman). *Mutation Research;* **116**: 423-429(1983). Contract AM06-76RL02221.

The mutagenicity of sodium azide in both higher plants and bacteria is well documented. However, in mammalian cells, research on the effects of azide on gene mutations has produced conflicting results. Furthermore, no research has been conducted on the effects of azide and its proximal mutagen (mutagenic metabolite) on DNA single-strand breaks. Experiments were designed to overcome this lack of information on azide mutagenicity and to evaluate the potential hazard of azide exposure to man. Chinese hamster V79 cells were treated with either azide or its proximal mutagen(s) for 2 or 6 h, respectively, and analyzed by alkaline elution for single-strand breaks. The data showed that neither azide nor the proximal mutagen(s) induced single-strand DNA breaks or DNA-protein cross links. Therefore it appears that neither azide nor its proximal mutagen(s) interact directly with DNA, and this suggests that azide may be an indirect-acting mutagen. Furthermore, this lack of interaction with DNA may account for azide's lack of carcinogenicity.

11699 **Open-ended rat tracheal implant model: toxic effects of formaldehyde on the respiratory epithelium.** Shiba, M.; Marchok, A.C.; Klein-Szanto, A.J.P. (Oak Ridge National Lab., TN). *Toxicology Letters;* **16**: 241-248(1983). Contract W-7405-ENG-26.

An open-ended rat tracheal implant model was developed to permit quantitative and repetitive exposure of respiratory epithelia to test substances of a variety of physical forms. To investigate the acute toxicity of formaldehyde with this new model, tracheas were exposed to formaldehyde solutions twice a week, for up to 12 weeks. At the higher formaldehyde concentrations (1.0, 0.6, 0.3%) the tracheal lumens became obstructed by granulation tissue. At the lower concentrations (0.2, 0.1, 0.01%), the appearance of flattened and atrophic epithelium as well as hyperplasia and squamous metaplasia were observed. The extent of these epithelial alterations was, for the most part, formaldehyde dose-dependent.

11700 **Zinc effects on glutathione metabolism relationship to zinc-induced protection from alkylating agents.** Seagrave, J.C.; Tobey, R.A.; Hildebrand, C.E. (Los Alamos National Lab., NM). *Biochemical Pharmacology;* **32**: No. 20, 3017-3021(1983).

Several aspects of the effects of zinc on the metabolism of glutathione were examined in the Chinese hamster cell (line CHO) and in three derived sublines which differ in their resistance to the thiol reactive heavy metal cadmium. In the parental CHO cell, which does not induce the synthesis of metallothionein in response

to zinc, glutathione levels remained approximately constant during the first 6 hr of zinc exposure. In the resistant cell lines, which induce the synthesis of metallothionein in response to zinc, the glutathione levels dropped transiently during zinc exposure. In all cell lines except the most cadmium resistant line, the glutathione levels after 12 hr were increased up to 3-fold relative to pretreatment levels. Similarly, the glutathione S-transferase activity measured by the conjugation of 1-chloro-2,4-dinitrobenzene to glutathione was increaed after 9-12 hr of zinc treatment in all except the most highly cadmium resistant cell line. Glutathione reductase was not affected consistently by zinc treatment; however, the level of activity of this enzyme in the most highly cadmium resistant line was two to three times greater than that observed in the other cell lines. These effects are considered in relation to the zinc-induced protection of these cells from the toxic effect of the alkylating agent melphalan.

11701 **Excision repair of ultraviolet- and chemically-induced damage in the DNA of fibroblasts derived from two closely related species of marine fishes.** Regan, J.D.; Snyder, R.D.; Francis, A.A.; Olla, B.L. (Oak Ridge National Lab., TN). *Aquatic Toxicology;* **4**: 181-188(1983). Contract W-7405-ENG-26.

The ability of an organism to modify chemical damages is an important factor in studies of the effect of xenobiotics on aquatic systems. The capacity of fibroblasts from two closely-related marine fishes, the tautog and the cunner, has been examined for excision repair of UV- and chemically-induced damage in their DNA. Two different assays, bromodeoxyuridine photolysis and the ara-C repair inhibition assay, were used to demonstrate the levels of both ultraviolet and chemical excision repair. They are extremely low in these cells compared to that seen in normal human fibroblasts. In addition, while the levels of repair of N-acetoxyacetyl-aminofluorene (N-AAAF) and ethyl methanesulfonate damage are about the same in both fish, interesting differences were seen between the two species in the levels of repair of 4-nitroquinoline-1-oxide, methyl methanesulfonate and UV-induced lesions.

11702 **Microbial mutagenicity of 3- and 4-ring polycyclic aromatic sulfur heterocycles.** Pelroy, R.A.; Stewart, D.L.; Tominaga, Y.; Iwao, M.; Castle, R.N.; Lee, M.L. (Battelle Memorial Inst., Richland, WA). *Mutation Research;* **117**: 31-40(1983). Contract AC02-79EV10237.

The stable isomers of 3- and 4-ring polycyclic aromatic sulfur heterocycles were tested for mutagenicity in the Ames standard plate incorporation test and a liquid pre-incubation modification of the Ames test. Of the 4 three-ring compounds tested, only naphtho[1,2-b]thiophene was mutagenic. Of the four-ring compounds, 7 of 13 were mutagenic in the standard Ames or pre-incubation Ames test. The highest activity for the 4-ring compounds was observed for phenanthrol[3,4-b]thiophene, a compound of approximately the same mutagenic potency in the Ames test as benzo[a]pyrene. The other active 4-ring compounds were of considerable less mutagenic potency than phenanthrol[3,4-b]thiophene. Mutagenicity for two of the 4-ring aromatic thiophenes could only be detected in the liquid pre-incubation Ames test. Salmonella typhimurium TA100 was the most sensitive strain to mutagenesis by these compounds, followed by TA98. All mutagenesis was indirect, requiring metabolic activation.

11703 **Metal regulation and toxicity in aquatic organisms.** Jenkins, K.D.; Sanders, B.M.; Sunda, W.G. (California State Univ., Long Beach). pp 277-287 of Mechanism of drug action. New York, NY, USA; Academic Press, Inc. (1983). Contract AC03-83ER60151.

The use of metal-chelate buffer systems for examining metal bioavailability, metabolism, and toxicity in aquatic organisms is reviewed and some of the advantages of this technique are described. Some studies on the effects of copper-manganese interactions on phytoplankton and on how free cupric ion activity affects metallothionen and growth in crab larvae are also reviewed.

11704 **Survival, respiration, and food assimilation of Daphnia magna exposed to petroleum- and coal-derived oils at three temperatures.** Ullrich, S.O. Jr.; Millemann, R.E. (Oak Ridge National Lab., TN). *Canadian Journal of Fisheries and Aquatic Science;* **40**: No. 1, 17-26(1983). Contract W-7405-ENG-26.

Acute toxicity tests with the water-soluble fractions (WSFs) of both oils showed that mortality of Daphnia magna was directly related to temperature and WSF concentration. The coal-derived oil was more toxic than the diesel fuel oil. The 48-h LC50s for the former were 0.70, 0.44, and 0.18% at 10, 20, and 25°C, respectively; the values for the diesel oil WSF were 87, 32, and 9.7% at 10, 20, and 25°C, respectively. Respiration rates of animals exposed to sublethal concentrations of the WSFs at 10, 20, and 25°C were significantly affected by the WSF concentration of the oils and temperature. The interaction between the concentration of each oil with temperature was statistically significant. Low concentrations of diesel oil WSF stimulated respiration rates at each temperature, but higher concentrations depressed them. At all temperatures, oxygen consumption rates of animals exposed to the coal-derived oil WSF decreased with increased concentration. The exposure to sublethal concentrations of both oils affected food assimilation of the animals in a manner similar to that observed when respiration was the criterion of toxic effect. The interaction between diesel oil WSF concentrations and temperature, but not between coal oil WSF concentrations and temperature, was statistically significant. At 20 and 25°C, low concentrations of diesel oil WSF stimulated assimilation rates, whereas low concentrations of the coal oil WSF depressed them. Generally, high concentrations of both WSFs depressed assimilation rates below control values. These results emphasize the importance of natural stresses, such as temperature, in enhancing toxicity of synthetic chemicals to aquatic organisms, and they reinforce the need to consider such variables as season of the year in evaluating biotic effects of oil spills.

11705 **Effect of ethyl-, methyl- and hydroxyethyl-nitrosourea on the mouse testis.** Oakberg, E.F.; Crosthwait, C.D. (Oak Ridge National Lab., TN). *Mutation Research;* **108**: 337-344(1983). Contract W-7405-ENG-26.

Hybrid male 101 x $C3HF_1$ mice were given intraperitoneal injections of methyl-, ethyl- and hydroxyethyl-nitrosourea and killed 3-16 days later. All compounds were similar in that all differentiating spermatogonia from type A_1 to early type B were killed by 50 mg/kg and higher doses of ENU and by 75 mg/kg MNU. Cells exposed to leptotene to 100 and 250 mg/kg ENU and 455 mg/kg HENU showed a delayed response with degeneration in pachytene 5 days later. Labeling prior to exposure to ENU indicated that the effect of stage of the mitotic cycle on sensitivity to cell killing is less marked than for radiation. This may be the explanation for the s-shaped mutation induction curve obtained with ENU in contrast to the humped dose-response curve observed for radiation.

11706 **Dosimetry of PAH skin carcinogenesis: covalent binding of benzo[a]pyrene to mouse epidermal DNA.** Shugart, L.; Holland, J.M.; Rahn, R.O. (Oak Ridge National Lab., TN). *Carcinogenesis (New York);* **4**: No. 2, 195-198(1983). Contract W-7405-ENG-26.

Benzo[a]pyrene (BaP) is metabolized to the chemically reactive anti and syn isomers of the 7,8-diol-9,10-epoxides of BaP (BPDE) which bind covalently to DNA to form DNA/BPDE complexes. Tetrols liberated from the DNA/BPDE complex by acid hydrolysis are easily quantified by h.p.l.c. using fluorescence detection. This approach allows femtomole amounts of BPDE associated with the DNA isolated from a single mouse to be detected using conventional instrumentation. The usefulness of this technique to estimate the interaction of BaP with DNA of mouse skin, both in the intact animal and in organ culture, was investigated. With mouse skin in organ culture it could be demonstrated that: (1) upon a single topical application of 5 μg of BaP, binding to DNA occurred via BPDE at a linear rate for up to 65 h, (2) the amount of binding was dose dependent at concentrations of BaP <10 μg.

11707 Response of the adrenergic system in the cadmium-induced hypertensive rat. Revis, N.W.; Major, T.C.; Horton, C.Y. (Oak Ridge National Lab., TN). *Journal of the American College of Toxicology;* **2**: No. 2, 165-174(1983). Contract W-7405-ENG-26.

Previous investigators, using an in vitro system, have shown that cadmium inhibits neuronal uptake of norepinephrine (NE). The current studies were performed to determine if the adrenergic system is altered in the cadmium-induced hypertensive rat. The results show that the Fischer and Sprague-Dawley rats develop hypertension, whereas the Wistar normotensive and Wistar hypertensive rats develop hypotension when exposed to 5 ppm of cadmium via drinking water. Results from these studies also show that in the cadmium-induced hypertensive rat, plasma NE is significantly elevated and that plasma clearance of [^{3}H]NE is significantly reduced. However, the changes in NE metabolism observed in the hypertensive rats were also observed in hypotensive rats. Furthermore in the Wistar strain, renal artery cadmium levels were significantly higher than observed in the other two strains. The authors suggest that the direction of change in blood following cadmium treatment is associated with both the plasma level of norepinephrine and the arterial level of cadmium.

11708 Pathology of acute inhalation exposure to 3-methylfuran in the rat and hamster. Haschek, W.M.; Morse, C.C.; Boyd, M.R.; Hakkinen, P.J.; Witschi, H.P. (Oak Ridge National Lab., TN). *Experimental and Molecular Pathology;* **39**: 342-354(1983). Contract W-7405-ENG-26.

The acute inhalation toxicity of 3-methylfuran (3MF) was investigated in SPF Fischer-derived and CD/CR rats, and golden Syrian hamsters by determination of the 2-week LC_{50}, and by histologic examination of animals killed 1, 3, and 14 days following a 1-hr exposure to 148 and 322 μmole 3MF/liter for CD/CR rats and hamsters, respectively. The Fischer-derived rat was more sensitive to 3MF-induced lethality than the CD/CR rat with an LC_{50} in the male rat of 81 μmole/liter-1 hr as compared to 222 μmole/liter-1hr. No sex difference was found. The hamster was relatively resistant with no lethality at 322 μmole 3MF/liter-2 hr. Pulmonary damage was present in both species. In the hamster, selective necrosis of nonciliated bronchiolar epithelial (Clara) cells was seen at 1 day with virtually complete regeneration by 14 days whereas in the rat the bronchiolar epithelial damage was more extensive and was followed by scattered peribronchiolar fibrosis and epithelial mucous metaplasia suggestive of "small airway disease" of man. Relatively selective 3MF-induced necrosis of olfactory epithelium occurred in the nasal mucosa of both species. Resolution of this lesion was seen by 14 days in the hamster. In the rat, however, the necrosis was much more extensive and was followed by partially occlusive fibrosis of the nasal cavity as seen at 14 days. 3MF also induced centrilobular hepatic necrosis in both species. In the rat, lymphocyte necrosis in the thymus and spleen, and esophageal necrosis was also seen.

11709 SCE induction is proportional to substitution in DNA for thymidine by CldU and BrdU. Heartlein, M.W.; O'Neill, J.P.; Preston, R.J. (Univ. of Tennessee, Oak Ridge). *Mutation Research;* **107**: 103-109(1983). Contract W-7405-ENG-26.

The incorporation of 5-bromo- and 5-chlorodeoxyuridine into cellular DNA and the induction of sister-chromatid exchanges (SCE) was examined with Chinese hamster ovary cells in culture. Although CldU caused 3-5 times more SCE than BrdU at equal extracellular concentrations, the 2 analogs were incorporated into DNA in place of thymidine similarly over a concentration range of 0.5-20 μM. The results show that SCE induction is linearly proportional to substitution for thymidine by both BrdU and CldU. Finally, based on linear extrapolation, a spontaneous level of ~ 6 SCEs per cell is estimated.

11710 Cell specific activation of benzo[a]pyrene by fibroblasts and hepatocytes. Jones, C.A.; Santella, R.M.; Huberman, E.; Selkirk, J.K.; Grunberger, D. (Argonne National Lab., IL). *Carcinogenesis (New York);* **4**: No. 11, 1351-1357(1983). Contract W-7405-ENG-26.

The cell specific activation of benzo[a]pyrene (BP) by embryonic fibroblasts and by mature hepatocytes to intermediates that can interact with DNA, or cause mutations in Chinese hamster V79 cells has been investigated. At BP concentrations of up to 15μM, BP was activated to mutagenic intermediates for the V79 cells by embryonic fibroblasts but not by hepatocytes. However, hepatocytes from rats that had been pretreated with an inducer of the mixed function oxidases, 3-methylcholanthrene, did metabolize higher doses of BP (<15 μM) to mutagenic intermediates. BP was extensively metabolized by both cell types, but the hepatocytes and fibroblasts showed differences both in the profiles of BP metabolites and the nature of the BP-DNA adducts formed. Hepatocytes metabolized BP principally to 4,5-dihydro-4,5-dihydroxybenzo[a]pyrene, phenols, and quinones, which underwent further metabolism to water-soluble metabolites. Metabolism of BP to 7,8-dihydro-7,8-dihydroxybenzo[a]-pyrene (BP-7,8-diol) occurred but proceeded rapidly to the formation of triols and tetraols. Fibroblasts metabolized BP predominantly toward the formation of BP-7,8-diol. The proportion of primary metabolites undergoing further metabolism to conjugates was less extensive than in the hepatocytes. Hepatocytes bound more BP to their DNA than the fibroblasts. In the hepatocytes the major DNA adducts formed were hydrophilic derivatives, and no [+/-]7β-dihydroxy-9α,10α-epoxy-7,8,9,10-tetrahydrobenzo[a]pyrene (BPDE) adducts were detected even after treatment with BP-7,8-diol. In the fibroblasts, the major BP - DNA adduct was derived from the reaction of BPDE with deoxyguanosine.

11711 Studies on the relationship between dimethylnitrosamine-demethylase activity and dimethylnitrosamine-dependent mutagenesis in Drosophila melanogaster. Waters, L.C.; Nix, C.E.; Epler, J.L. (Oak Ridge National Lab., TN). *Chemico-Biological Interactions;* **46**: 55-66(1983). Contract W-7405-ENG-26.

The relationship between dimethylnitrosamine (DMN) demethylase activity and DMN-induced mutagenesis was investigated in Drosophila melanogaster. The activity of DMN-demethylase was at least 10-fold greater in the Hikone-R strain than in three other Drosophila strains. However, the sex-linked recessive lethal (SLRL) mutations induced by DMN in the four strains differed by less than 2-fold. Several possibilities to explain the lack of correlation between DMN-demethylase activity and DMN-induced mutations were tested and eliminated. They include: (1) the presence of inhibitors of DMN-demethylase in extracts of low-activity strains, (2) a sex bias in the Hikone-R strain in which the enzyme activity is confined to the females, (3) the possibility that DMN treatment induces DMN-demethylase activity in the low-activity strains, and (4) the possibility that Hikone-R has a much more efficient DNA repair system than the other strains. The results are discussed in terms of what is known about the role of DMN-demethylase in the metabolic activation of DMN in other systems. 39 references.

11712 Lung changes in rats inhaling volcanic ash for one year. Wehner, A.P.; Dagle, G.E.; Clark, M.L. (Battelle Pacific Northwest Labs., Richland, WA). *American Review of Respiratory Diseases;* **128**: 926-932(1983).

Rats were exposed to 5 mg/m^3 or 50 mg/m^3 (respirable aerosol concentration) volcanic ash, or to 50 mg/m^3 quartz, 6 h/day, 5 days/wk, for as long as 12 months. Subgroups of rats were killed at 4-month intervals to determine lesion development as a function of dose and cumulative exposure. Treatment-related lung changes comprised alveolar macrophage accumulation, interstitial reaction, peribronchiolar lymphoid hyperplasia, lymph node hyperplasia, and - in the 50-mg/m^3 ash-exposed and quartz-exposed rats - alveolar proteinosis. Some of the changes did not increase appreciably after 8 months of exposure, whereas others continued to increase as a function of cumulative exposure. Generally, there were distinct dose-response and agent-response relationships. These trends were also observed in lung weights, respiratory rates, and volumes of mediastinal lymph nodes. Like the histologic changes, the effects on these ancillary parameters also increased in the following order: sham-exposed control group, 5 mg/m^3 and 50 mg/m^3 ash-exposed groups, and quartz-exposed positive control group.

5604 Other Environmental Pollutant Effects

11713 **(CE-Trans—7730) Environmental effects of electro-magnetic fields.** Hauf, R. Translated from *Elektrotechnische Zeitschrift ;* **101**: No. 24, 1310-1312(1980). 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85900181. DE85900181

The effects of 50 hz electromagnetic fields on the health of humans is discussed. Both short-term and chronic exposure studies indicate no significant detrimental physiological reactions occur. (ACR)

57 HEALTH AND SAFETY

REFER ALSO TO CITATION(S) 57000011199

11714 (UCRL—52000-84-12, pp 9-19) **Mortality among the employees of Lawrence Livermore National Laboratory.** Dec 1984. NTIS, PC A03/MF A01. File Number DE85005541.

In Energy and Technology Review.

A study was undertaken to better understand the significantly higher incidence of malignant melanoma among Laboratory employees. The study cohort consisted of all employees from 1964 to 1979, no matter how briefly employed. Mortality rates from various causes were compared with rates based upon US vital statistics. The study revealed that mortality rates among the study cohort were significantly lower in nearly all categories than among the general population, a result attributed in part to the healthy worker effect. Cancer mortality is also lower among Laboratory employees, although the standardized mortality ratio (observed deaths/expected deaths) for all cancers is not as low as that for all causes of death. Further, the mortality ratio of malignant melanoma is not elevated significantly among Laboratory employees, though the incidence ratio is. To resolve this effect, we are extending the study to a larger population of Laboratory employees.

58 GEOSCIENCES

5801 Geology And Hydrology

REFER ALSO TO CITATION(S) 58010010992, 10997, 11185, 11198, 11200

5802 Geophysics

REFER ALSO TO CITATION(S) 58020010889, 10890

11715 **(USGS-OFR—78-336) Use of volunteers in the earthquake-hazards-reduction program: proceedings of conference IV.** Ward, P.L. (ed.). (Geological Survey, Menlo Park, CA (USA). Office of Earthquake Studies). 1978. 279p. (CONF-7802105—). USGS-OFR, Box 25425, Denver Federal Center, Denver, CO 80225. File Number TI83902524.

From 4. National Earthquake Hazards Reduction Program conference on use of volunteers; Menlo Park, CA, USA (2 Feb 1978).

The purpose was to discuss methods of involving volunteers in a meaningful way in earthquake research and in educating the public about earthquake hazards. The emphasis was on earthquake prediction research but many of the conclusions ranged over the whole earthquake hazard reduction program. Relevant papers have been individually abstracted for the data base. (ACR)

11716 (USGS-OFR—78-336, pp 70-86) **Public participation in studies of animal behavior prior to earthquakes: some cautionary remarks.** Skiles, D.D.; Lindberg, R.G. (Univ. of California, Los Angeles). 1978. USGS-OFR, Box 25425, Denver Federal Center, Denver, CO 80225. File Number TI83902524. (CONF-7802105—).

From 4. National Earthquake Hazards Reduction Program conference on use of volunteers; Menlo Park, CA, USA (2 Feb 1978).

A program promoting public participation in the scientific effort to determine the value of observations of animal behavior to the US earthquake prediction program is evaluated. The discussion is directed toward identifying the pros and cons of public participation rather than toward proposing a specific plan of action. 8 references. (ACR)

11717 (USGS-OFR—78-336, pp 87-96) **Use of volunteer observers to detect abnormal animal behavior prior to earthquakes.** Verosub, K.L.; Lott, D.F.; Hart, B.L. (Univ. of California, Davis). 1978. USGS-OFR, Box 25425, Denver Federal Center, Denver, CO 80225. File Number TI83902524. (CONF-7802105—).

From 4. National Earthquake Hazards Reduction Program conference on use of volunteers; Menlo Park, CA, USA (2 Feb 1978).

The technical aspects of using observations of animal behavior reported by the general public to predict earthquakes are discussed. The possibilities and problems inherent in two alternative approaches are explored. One approach would be to obtain daily reports of egg and milk production on farms along faults. The other approach would be to encourage a selected group of volunteer observers to report all observations of apparently abnormal animal behavior. (ACR)

11718 (USGS-OFR—78-336, pp 97-123) **Mobilizing the masses in China.** Turner, R.H. (Univ. of California, Los Angeles). 1978. USGS-OFR, Box 25425, Denver Federal Center, Denver, CO 80225. File Number TI83902524. (CONF-7802105—).

From 4. National Earthquake Hazards Reduction Program conference on use of volunteers; Menlo Park, CA, USA (2 Feb 1978).

Mass involvement in the Chinese earthquake-hazard mitigation program was investigated. The effort includes involvement both before and after a prediction is made. The history of the Chinese effort is described, and differences between the Chinese and US in attitudes towards earthquake prediction and in programs directed towards earthquake prediction are detailed. (ACR)

11719 (USGS-OFR—78-336, pp 124-128) **Catfish Club.** Raleigh, C.B. (Geological Survey, Menlo Park, CA). 1978. USGS-OFR, Box 25425, Denver Federal Center, Denver, CO 80225. File Number TI83902524. (CONF-7802105—).

From 4. National Earthquake Hazards Reduction Program conference on use of volunteers; Menlo Park, CA, USA (2 Feb 1978).

A brief description is given of an amateur volunteer organization in Japan which aids in earthquake prediction. The group measures water level in shallow wells as well as barometric pressure and precipitation on a daily basis. (ACR)

11720 (USGS-OFR—78-336, pp 129-155) **Use of volunteer organizations in emergency operations.** Pulley, H.R. 1978. USGS-OFR, Box 25425, Denver Federal Center, Denver, CO 80225. File Number TI83902524. (CONF-7802105—).

From 4. National Earthquake Hazards Reduction Program conference on use of volunteers; Menlo Park, CA, USA (2 Feb 1978).

This paper describes four examples of the use of volunteer organizations in operations of the California Office of Emergency Services (OES), outlines the criteria under which they have been utilized, and presents observations as to how these procedures can be transferred to the task of earthquake prediction. The organizations discussed are the American National Red Cross, Civil Air Patrol, Radio Amateur Civil Emergency Service, and Structural Engineers Association of California. (ACR)

11721 **Carbon abundances in mantle minerals determined by nuclear reaction analysis.** Mathez, E.A.; Blacic, J.D.; Beery, J.; Maggiore, C.; Hollander, M. (Department of Geological Sciences, University of Washington, Seattle). *Geophysical Research Letters;* **11**: No. 10, 947-950(Oct 1984).

Profiles of C concentration versus depth were determined in a spinel megacryst and two olivine crystals of a mantle xenolith from Kilbourne Hole, New Mexico, using the $^{12}C(d,p)^{13}C$ nuclear

reaction technique. The 0-1400 A layers of all crystals are characterized by C concentrations of ~1000 wt. ppm. This C is interpreted to be a contaminant acquired during sample preparation or ion bombardment. Below the surface, measurable C concentrations were not found in the spinel and one of the olivine crystals, but a bulk C content of 425 ppm was measured for a second crystal. The latter is interpreted to be due to the presence of discrete C-rich phase(s) in submicroscopic inclusions or microcracks rather than C dissolved in the crystal lattice. The detection limit potentially obtainable by the (d,p) reaction technique for bulk C in minerals in several 10's of ppm.

11722 **Horizontal propagation of P waves through scattering media: analog model studies relevant to long-range P/ sub n/ propagation.** Menke, W.; Richards, P.G. (Columbia Univ., Palisades, NY). *Bulletin of the Seismological Society of America;* **73**: No. 1, 125-142(Feb 1983).

The authors compare seismograms produced through the use of analog models of scattering and nonscattering Earth structure to access the effect of lateral heterogeneities on the horizontal propagation of P waves. The results are applicable to propagation out to 16° and to periods as short as 5 sec. It was found that layers of scatterers within the mantle near the turning points of P waves can cause these phases to have long coda similar in certain respects to the coda observed in long-range P/sub n/. The overall appearance of this coda is similar to that produced in laterally homogeneous models that include low-velocity crustal material near their surfaces. Scatterers at shallower depths in the mantle or crust have a different effect. Those in very uppermost mantle seem to suppress the horizontal propagation of P waves while those in the crust have very little overall effect, at least at the perod range studied. It was also found that the scatterers have an amplifying effect on the horizontal propagation of the very longest periods (>20 sec), an effect that may be related to the scattering-controlled boundary waves discovered by Biot (1968).

5803 Mineralogy, Petrology, And Rock Mechanics

REFER ALSO TO CITATION(S) 58030010950, 10967, 10989, 10991, 10998

11723 **(BMI/OCRD—7) Expected repository environments in granite: thermal environment.** Osnes, J.D.; Coates, G.K.; DeJong, K.B.; Loken, M.C.; Wagner, R.A. (RE/SPEC, Inc., Rapid City, SD (USA)). Oct 1984. Contract AC02-83CH10139;AC02-83CH10140. 288p. NTIS, PC A13/MF A01; 1; GPO Dep. File Number DE85006261.

This report was prepared for the Reference Repository Conditions - Interface Working Group and will be used to formulate a standardized description of repository conditions for use by the Civilian Radioactive Waste Management Program. A baseline repository in granite is defined and three waste types are considered: unreprocessed spent fuel, commercial high-level waste, and defense high-level waste. Three different scales of repository environment are described - the very-near field (near the waste canister), the near field (the room and pillar), and the far field (the entire repository and surroundings). Information was compiled from the literature and, in addition, a number of calculations were performed. The major emphasis is on describing the thermal environment although the ground-water flow and chemical and radiation environments are also described. 61 figures, 24 tables.

11724 **(DOE/ER/13216—1) Deformation of granitic rocks at elevated temperatures and pressures. Interim report, 1 March-15 December 1984.** Carter, N.L. (Texas A and M Univ., College Station (USA). Research Foundation). 1985. Contract FG05-84ER13216. 14p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85004871.

Research progress is reported for a study to determine the evolution of substructure and mechanical behavior of westerly granite and oceanic layer 2 basalt. 7 references, 6 figures. (ACR)

11725 **(LBL—17514) Effects of fracture roughness on fluid flow through a single deformable fracture.** Tsang, Y.W.; Witherspoon, P.A. (Lawrence Berkeley Lab., CA (USA)). Oct 1984. Contract AC03-76SF00098. 16p. (CONF-850101—4). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004593.

From International congress on hydrology of rocks of low permeability; Tucson, AZ, USA (7 Jan 1985).

The cubic law for fluid flow through a single fracture commonly employed in simulations of fluid flow through a fractured medium assumes the smooth parallel-plate idealization of each fracture. This paper summarizes results of theoretical investigations on the effects of fracture surface roughness on fluid flow through a single deformable fracture. We constructed a theory to relate the geometrical characteristics of the fracture to its mechanical properties so that an aperture density distribution for the fracture may be derived from fracture stress-strain measurements. A review of available fracture roughness profiles showed that the aperture density distributions of real fractures may take on various shapes: sharply peaked, broad and flat, skewed and peaked toward the large apertures or toward the small apertures. The different shapes give rise to qualitatively different variations of flow rate with normal stress applied to the fracture. Calculations were first carried out for flow with no tortuosity; then the effect of path tortuosity and connectivity on fluid flow rate were investigated. Our calculations show that for fractures with aperture distribution that is sharply peaked toward the large apertures, the effect of tortuosity is minimal and the fracture remains hydraulically open though its mechanical properties may approach that of an intact rock. On the other hand, when the aperture distribution is dominated by small apertures and when the contact area of the fracture surfaces is above 30%, the effect of tortuosity may depress the fluid flow rate by two or three more orders of magnitude from that predicted by the parallel-plate idealization of the fracture. Thus the applicability of a parallel-plate mean aperture to the description of flow behavior in a rough fracture is limited. 21 references, 10 figures.

11726 **Dislocation model of the stress history dependence of frictional slip.** Olsson, W.A. (Geomechanics Division, Sandia National Laboratories, Albuquerque, New Mexico). *Journal of Geophysical Research;* **89**: No. B11, 9271-9280(10 Oct 1984).

Frictional slippage on material interfaces is pervasive in mechanical problems of all types, but it can be particularly important in geomechanics. Extent models of cracked or jointed rock usually take frictional resistance along rock interfaces to be described by uniform Coulomb friction. A simple theory is presented which incorporates nonuniform friction. The description is by means of continuous distributions of infinitesimal dislocations. The resulting stress-plastic strain behavior is nonlinear and stress history dependent and is a result of the generation, interaction, and annihilation of slip zones of unlike sign. The theory provides an explanation for the discrete memory effect observed during cyclic stressing of rock and also indicates potential difficulties in the design and interpretation of experiments on jointed rock.

11727 **Model for deformation in Long Valley, California, 1980-1983.** Rundle, J.B.; Whitcomb, J.H. (Geophysics Division, Sandia National Laboratories, Albuquerque, New Mexico). *Journal of Geophysical Research;* **89**: No. B11, 9371-9380(10 Oct 1984).

Geodetic data collected in Long Valley, California, from 1975 through 1981 define a pattern of uplift and strain which is evidently associated with a sequence of earthquakes occuring in May 1980 and subsequent swarm activity continuing until the present. We have constructed a model to explain the deformation observed since May 1980 in terms of inflation of two subsurface magma chambers, faulting in the south most region of the caldera, and slip in the Hilton Creek fault. The most significant new feature of the model is the shallow magma chamber at 5 km depth, located a few hundred meters to the east of the Casa Diablo hot spring area. Inflation of this chamber cause stresses which show consistency with various aspects of the seismicity in the south moat of the calcers. Calculations of stress across vertical planes over the magma chambers can be used together with failure criteria to estimate the infla-

tion volume at which the rock layers intervening between the chamber and the surface will fail by extensional fracture.

11728 **Explosive-induced wave propagation in nugget sandstone.** Larson, D.B. (University of California, Lawrence Livermore National Laboratory, Livermore). *Journal of Geophysical Research;* **89**: No. B11, 9415-9424(10 Oct 1984).

Explosion-induced particle velocity time histories have been recorded in Nugget sandstone at confining pressures between 0.1 and 34.5 MPa using explosive sources with energies 0.6 and 300 kJ. The measured peak particle velocities and peak displacements are insensistive (within the experimental scatter of +- 3%) to confining pressures. Smaller cavities are produced at higher confining pressure, but this reduction in cavity sizes can be attributed to increasing rock strength with confining pressure rather than to confining pressure per se. The recorded free field motion shows a strong departure from elastic behavior, giving average Q or attenuation factors between 8 and 20. Integration of the measured particle velocities to determine permanent displacements gives values an order of magnitude larger than expected from the measured cavity size. This observation suggests that the stress wave causes significant dilation of the rock near the the explosion as it travels outward from the spherical energy source.

5804 Geochemistry

REFER ALSO TO CITATION(S) 58040010998, 11001

5805 Oceanography

11729 **(DOE/EV/10331—4) Nearshore transport processes affecting the dilution and fate of energy-related contaminants. Progress report, June 1, 1981-November 30, 1984.** Blanton, J.O. (Skidaway Inst. of Oceanography, Savannah, GA (USA)). 17 Dec 1984. Contract AS09-80EV10331. 30p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85004888.

Physical exchange processes on the inner continental shelf of the South Atlantic Bight were investigated. A numerical model of a small section of the inner shelf which is driven by the M2 tide at the shelf break was constructed. Available current meter data in regions shallower than 20 m where the frictional influence of surface and bottom stress are likely to merge was investigated. (ACR)

11730 **Shelfbreak circulation, fronts and physical oceanography: east and west coast perspectives.** Pietrafesa, L.J. (North Carolina State Univ., Raleigh). *SEPM Special Publication;* No. 33, 233-250(Jun 1983).

A survey of fundamental physical oceanographic processes that may affect sediment distribution along shelfbreak regions is presented, emphasizing the Atlantic and Pacific coasts of the USA. These shelfbreak strips couple the bounded coastal oceans to the open seas, but there is no systematic pattern to this coupling. Pacific coast shelfbreak processes tend to be less energetic than those on the Atlantic coast since the Pacific coast is missing a Western Boundary Current and because the shelf is narrow and deep. Subinertial frequency shelfbreak motions on the west coast are typically manifested across the entire shelf, while those on the east coast tend to be confined to a loosely defined band, which brackets the break. Principal Pacific coast circulation elements include forms of continental shelf waves and thermohaline driven and mechanically wind forced currents, as well as the California Current System. While high frequency edge waves and inertial current are indigenous in similar fashion to all coasts, east and west coast tides are shown to be quite disparate, given tradeoffs between dominance of diurnal and semidiurnal constituents as a function of topographic constraint and strength of density stratification. All of the shelfbreak zones are graced by thermohaline fronts. The fronts are progradational on the west and southeastern coasts and retrogradational on the northeastern shelf. These fronts are an integral ingredient of all aspects of physical processes at the shelfbreak strip. The interplay of bottom topography with the physics of the outer continental margin is significant. Bottom features such as shoals, bumps, ridges and canyons are shown to be regions of sediment erosion, deposition and draping. Moreover, these features are shown to be casually related to upwelling and downwelling phenomena and to the deflection and scattering of waves and currents.

11731 **Effects of alongshore variation in bottom topography on a boundary current (topographically induced upwelling).** Janowitz, G.S.; Pietrafesa, L.J. (North Carolina State Univ., Raleigh). *Continental Shelf Research;* **1**: No. 2, 123-141(1982). Contract AS09-76EV00902.

A theory which describes the constant f-plane flow of a steady inviscid baroclinic boundary current over a continental margin with a bathymetry that varies slowly in the alongshore but rapidly in the offshore directions is developed in the parameter regime (L/sub d//L)^2 $\leqq$ Ro $<$ 1, where L/sub D/ is the internal deformation radius, L the horizontal length scale, and Ro the Rossby number. To the lowest order in the Rossby number, the flow is along isobaths with speed q/sub o/ = V/sub u/(h. z)absolute value/a, where V/sub u/(h, z) is the upstream speed, α the upstream bottom slope at depth h, and nabla h the bottom slope downstream at depth h. The lowest order flow produces a variation in the vertical component of relative vorticity along the isobath as the magnitude and direction of nabla h vary in the downstream direction. The variation of vorticity requires a vertical as well as a cross-isobath flow at first order in the Rossby number. The first order vertical velocity is computed from the vorticity equation in terms of upstream conditions and downstream variations of the bathymetry. The density, pressure, and cross-isobath flow at first order in the Rossby number are then calculated. It is shown that in the cyclonic region of current (d/dh(V/sub u//α) $>$ 0), if the isobaths diverge in the downstream direction ((d/ds)absolute value $<$ 0), then upwelling and onshore flow occur. The theory is applied to the northeastern Florida shelf to explain bottom temperature observations.

64 PHYSICS. I.

11732 **(N—84-33336) RLE Progress Report No. 126.** Allen, J.; Birgeneau, R.J. (Massachusetts Inst. of Tech., Cambridge (USA)). Jan 1984. 270p. NTIS, PC A12/MF A01.

Topics discussed include: molecular microscopy, semiconductor surfaces, atomic resonance and scattering, chemical reaction dynamics, X-ray diffuse scattering, optics and quantum electronics, photonics, quantum magnetics, radio astronomy, remote sensing, plasma dynamics, communication networks, digital signal processing, speech communication, custom integrated circuits, and physiology.

6401 Astrophysics And Cosmology

REFER ALSO TO CITATION(S) 64010011811

11733 **(AD-A—147435/2/XAB) Region 1 Birkeland currents from a global MHD simulation of the magnetosphere. Memorandum report, October 1984-October 1985.** Fedder, J.A.; Lyon, J.G. (Naval Research Lab., Washington, DC (USA)). 28 Sep 1984. 31p. (NRL-MR—5397). NTIS, PC A03/MF A01.

The study of large-scale geomagnetic-field-aligned currents, which couple the dynamics of the magnetosphere and the high-latitude ionosphere, has been an area of intense research interest in recent years. These currents, first postulated by Birkeland (1908) to be responsible for geomagnetic activity and auroral phenomena in the polar regions, were first observed in the 1970's by Arnoldy, Zmuda and Armstrong and Sugiura and have now been extensively measured and documented by satellite and rocket magnetometers. The large-scale Birkeland currents are observed in two rings that encircle the polar regions. The poleward ring has been called the Region 1 system and the equatorward ring the Region 2 system. Global numerical MHD simulation data for the earth's magnetosphere was used to calculate Birkeland current systems in the polar ionosphere. In this report, results are shown for the Region 1 Birkeland currents. It is demonstrated how the currents are organized on open or closed field lines in daytime and nighttime sectors. The

current source regions are identified and driving mechanisms are discussed.

11734 (AD-A—147561/5/XAB) Charge-state composition of 0.4-MeV helium ions in earth's outer radiation belts during quiet times. Technical report. Chenette, D.L.; Blake, J.B.; Fennell, J.F. (Aerospace Corp., El Segundo, CA (USA). Space Sciences Lab.). 30 Sep 1984. 29p. NTIS, PC A03/MF A01.

The charge state of 0.40 - 0.55 MeV helium ions in earth's outer magnetosphere (L alpha 6) was measured using a novel technique. The radial gradient of the helium ion flux and the east-west anisotropy in the pitch-angle distribution were both measured. These are combined with measurements of the magnetic field to calculate the flux-weighted average ion gyroradius. Since the magnitude of the magnetic field and the energies of the ions are known, the gyroradius determines the ion's charge state. During two pairs of geomagnetically quiet days in 1979 most of these ions were found to be singly charged. This result is in accord with theoretical calculations that find that charge-exchange reactions between these ions and the neutral hydrogen geocorona are the dominant factors in controlling the charge state of these ions at times longer than a day after their injection. The results also suggest that the mean charge state of these helium ions may vary with position in the magnetosphere and with time.

11735 (BNL—35728) Chlorine solar neutrino experiment. Rowley, J.K.; Cleveland, B.T.; Davis, R. Jr. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 21p. (CONF-8408132—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005208.

From Conference on solar neutrinos and neutrino astronomy; Lead, SD, USA (23 Aug 1984).

The chlorine solar neutrino experiment in the Homestake Gold Mine is described and the results obtained with the chlorine detector over the last fourteen years are summarized and discussed. Background processes producing ^{37}Ar and the question of the constancy of the production rate of ^{37}Ar are given special emphasis.

11736 (CONF-8408132—6) Proposed solar neutrino experiment using $^{81}Br(nu,e^-)^{81}Kr$. Hurst, G.S.; Chen, C.H.; Kramer, S.D.; Allman, S.L. (Oak Ridge National Lab., TN (USA); Tennessee Univ., Knoxville (USA)). Dec 1984. Contract AC05-84OR21400. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004802.

From Conference on solar neutrinos and neutrino astronomy; Lead, SD, USA (23 Aug 1984).

It has now been shown that it is feasible to measure the ^{7}Be neutrino source in the sun by using the reaction $^{81}Br(nu,e^-)^{81}Kr$ in a radiochemical experiment. Such an experiment would be quite similar to the Davis, Cleveland, and Rowley method for measuring the ^{8}B neutrino using $^{37}Cl(nu,e^-)^{37}Ar$ except that the resonance ionization spectroscopy (RIS) method (instead of decay counting) would be employed to count the 2×10^5-yr ^{81}Kr atoms.

11737 (FNAL/C—84/105) Phase transitions and dark matter problems. Schramm, D.N. (Chicago Univ., IL (USA); Fermi National Accelerator Lab., Batavia, IL (USA)). Oct 1984. Contract AC02-76CH03000. 11p. (CONF-8406234—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85003951.

From International symposium on phase transitions in the very early universe; Bielefeld, F.R. Germany (1 Jun 1984).

The possible relationships between phase transitions in the early universe and dark matter problems are discussed. It is shown that there are at least 3 distinct cosmological dark matter problems: (1) halos; (2) galaxy formation and clustering; and (3) $\Omega = 1$, each emphasizing different attributes for the dark matter. At least some of the dark matter must be baryonic but if problems 2 and 3 are real they seem to also require non-baryonic material. However, if seeds are generated at the quark-hardon-chiral symmetry transition then alternatives to the standard scenarios may occur. At present no simple simultaneous soiution (neither hot, warm, nor cold) exists for all 3 problems, but non-standard solutions with strings, decaying particles or light not tracing to mass may work. An alternative interpretation of the relationship of the cluster-cluster and galaxy-galaxy correlation functions using renormalized scaling is mentioned. In this interpretation galaxies are more strongly correlated and the cluster-cluster function is not expected to go negative until $\geqq$ 200 Mpc. Possible phase transition origins for the cluster-cluster renormalized scale are presented as ways to obtain a dimension 1.2 fractal. 64 references.

11738 (FNAL/C—84/111-A) Superheavy magnetic monopoles and the standard cosmology. Turner, M.S. (Fermi National Accelerator Lab., Batavia, IL (USA); Chicago Univ., IL (USA). Enrico Fermi Inst.). Oct 1984. Contract AC02-76CH03000. 24p. (CONF-8310227—10). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85003922.

From Monopole '83 conference; Ann Arbor, MI, USA (6 Oct 1983).

The superheavy magnetic monopoles predicted to exist in grand unified theories (GUTs) are very interesting obsects, both from the point of view of particle physics, as well as from astrophysics and cosmology. Astrophysical and cosmological considerations have proved to be invaluable in studying the properties of GUT monopoles. Because of the glut of monopoles predicted in the standard cosmology for the simplest GUTs (so many that the Universe should have reached a temperature of $3^{\circ}K$ at the tender age of $\sim$ = 10,000 yrs), the simplest GUTs and the standard cosmology are not compatible. This is a very important piece of information about physics at unification energies ($E \geqq 10^{14}$ GeV) and about the earliest moments ($t \leqq 10^{-34}$ s) of the Universe. In this talk the author reviews the cosmological consequences of GUT monopoles within the context of the standard hot big bang model. 46 references.

11739 (FNAL/C—84/117-A) Origin of cosmological density fluctuations. Carr, B.J. (Fermi National Accelerator Lab., Batavia, IL (USA); Queen Mary Coll., London (UK)). Nov 1984. Contract AC02-76CH03000. 17p. (CONF-8406234—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85003924.

From International symposium on phase transitions in the very early universe; Bielefeld, F.R. Germany (1 Jun 1984).

The density fluctuations required to explain the large-scale cosmological structure may have arisen spontaneously as a result of a phase transition in the early Universe. There are several ways in which such fluctuations may have ben produced, and they could have a variety of spectra, so one should not necessarily expect all features of the large-scale structure to derive from a simple power law spectrum. Some features may even result from astrophysical amplification mechanisms rather than gravitational instability. 128 references.

11740 (LA-UR—84-3566) Molybdenum solar neutrino experiment. Wolfsberg, K.; Cowan, G.A.; Bryant, E.A.; Daniels, K.S.; Dowrey, S.W.; Haxton, W.C.; Niesen, V.G.; Nogar, N.S.; Miller, C.M.; Rokop, D.J. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 8p. (CONF-8408132—4). NTIS, PC A02/MF A01; GPO Dep. File Number DE85003747.

From Conference on solar neutrinos and neutrino astronomy; Lead, SD, USA (23 Aug 1984).

The goal of the molybdenum solar neutrino experiment is to deduce the ^{8}B solar neutrino flux, averaged over the past several million years, from the concentration of ^{98}Tc in a deeply buried molybdenum deposit. The experiment is important to an understanding of stellar processes because it will shed light on the reason for the discrepancy between theory and observation of the chlorine solar neutrino experiment. Possible reasons for the discrepancy may lie in the properties of neutrinos (neutrino oscillations or massive neutrinos) or in deficiencies of the standard solar model. The chlorine experiment only measures the ^{8}B neutrino flux in current times and does not address possible temporal variations in the interior of the sun, which are also not considered in the standard model. In the molybdenum experiment, we plan to measure ^{98}Tc (4.2 Myr), also produced by ^{8}B neutrinos, and possibly ^{97}Tc (2.6 Myr), produced by lower energy neutrinos.

11741 **(N—84-29841) Imagery and spectroscopy of supernova remnants and H-2 regions.** Dufour, R.J. (Rice Univ., Houston, TX (USA)). Jun 1984. 13p. (NASA-CR—171799). NTIS, PC A02/MF A01.

Research activities relating to supernova remnants were summarized. The topics reviewed include: progenitor stars of supernova remnants, UV/optical/radio/X-ray imagery of selected regions in the Cygnus Loop, UV/optical spectroscopy of the Cygnus Loop spur, and extragalactic supernova remnant spectra.

11742 **(N—84-31068) Studies of X-ray clusters of galaxies/intergalactic plasmas. Final Report.** Scott, J.S. (Arizona Univ., Tucson (USA)). Aug 1984. 16p. (NASA-CR—173825). NTIS, PC A02/MF A01.

Intergalactic plasmas were investigated from both an observational and theoretical point of view. A multiobject spectrometer, the MX spectrograph was used to obtain detailed dynamical information on clusters of galaxies this information was then compared with X ray emission from hot gas in these clusters. Several spectra of galaxies are presented, and data reduction of the spectra was discussed. The existence of quasar winds in Seyfert galaxies and the interaction between such a wind and the interstellar medium also were considered.

11743 **(N—84-31079) Fundamental and harmonic emission in interplanetary type 2 radio bursts.** Lengyel-Frey, D.; Stone, R.G. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Apr 1984. 29p. (NASA-TM—86099). NTIS, PC A03/MF A01.

Three interplanetary type II radio bursts which show two prominent and long duration bands in their dynamic spectra were analyzed in detail and compared to similar bands in meter wavelength type II events. These bands, which differ by a factor of about two in frequency, were interpreted in terms of fundamental and harmonic emission. The fundamental component has a greater average intensity than the harmonic, due largely to short intense brightenings. The fundamental spectral profile is more narrow than that of the harmonic, with harmonic band typically exhibiting a larger bandwidth to frequency ratio than the fundamental by a factor of two. The fundamental has a larger source size than the harmonic, 160 degrees versus 110 degrees, on average, as viewed from the Sun. Two of the events have source positions which correlate well with the associated flare positions.

11744 **(PB—84-225036) Solar-geophysical data Number 477, May 1984. Part 2 (comprehensive reports). Data for November 1983, July 1981, and miscellanea.** (National Geophysical Data Center, Boulder, CO (USA)). May 1984. 92p. (SGD—477-PT-2). NTIS, PC A05/MF A01.

See also PB84-201516, and PB84-225028. Library of Congress catalog card No. 79-640375.

Contents: Data for November 1983--(Solar radio bursts at fixed frequencies, Mass ejections from the sun); Data for July 1981--Solar flares July 1981; Miscellaneous data--(Interplanetary solar wind data, Solar x-ray radiation from GOES 5).

11745 **1973 x-ray transient V0332+53.** Terrell, J.; Priedhorsky, W.C. (Los Alamos National Laboratory). *Astrophysical Journal, Letters to the Editor;* **285**: No. 1, L15-L18(1 Oct 1984).

A bright transient x-ray source, V0332+53, was observed by Vela 5B for 3 months in 1973. It was first clearly detected in the 10 day period centered on 1973 June 1, rose to an intensity of ~1.4 Crab in July, and was last definitely observed around 1973 August 30. The slow rise and symmetric fall of intensity are unusual for a transient X-ray source. Rapid fluctuations took the source to peak intensities above 2 Crab. The spectrum of this source (α = 1.0 +- 0.2) was among the hardest ever observed by Vela 5B. The location of V0332+53, in Camelopardalis, was l = 146°.11, b = -2°.16, with an uncertainty of ~0°.1. No other X-ray spacecraft appear to have been in position to observe this event, and no recurrence was detected by Vela 5B. The transient source which was detected at the same location by Temma and EXOSAT, in 1983 November, 10 years after the Vela observation, with a 4.4 s pulsation period, is almost certainly identical to V0332+53.

11746 **High energy transients in astrophysics .** Woosley, S.E. (ed.). New York, NY; American Institute of Physics (1984). 731p. (CONF-830797—). American Institute of Physics, 335 E. 45th Street, New York, NY 10017. File Number TI84013699. Contract W-7405-ENG-48.

From Workshop on high energy transients in astrophysics; Santa Cruz, CA, USA (11 Jul 1983).

High energy transients are the emissions of compact astronomical objects that exhibit rapid time variations in the x-ray and γ-ray band. More specifically the term is used to denote a generic class of high energy phenomena arising from the release of either gravitational or nuclear energy near the surface of an accreting neutron star. The time variation may be as rapid as a fraction of a millisecond, as in the case of some γ-ray bursters, or as long as several months in x-ray transients. Though studies of the various categories of high energy transients: x-ray transients, x-ray pulsars, x-ray bursts, and γ-ray bursts, have generally been carried out by diverse groups and instrumentation, sometimes having only peripheral contact, it is expected that similar physical processes may underlie all four phenomena. Thus, it was desirable to bring together experts, both observers and theoreticians, in all of these subjects to discuss recent progress in our understanding of high energy transients and to plan scientific strategy for the future. Since solar transient emissions in the x-ray and γ-ray band are also frequently studied with the same instrumentation and by some of the same scientists, they too were considered an appropriate topic for discussion. An additional theme of major importance throughout the meeting was the instrumentation currently being used and under development for the study of high energy transients. Separate entries were prepared for the data base for the papers presented. (WHK)

6402 Atmospheric Physics

11747 **(AD-A—143391/1) Influence of magnetic shear on the collisional current driven ion cyclotron instability. Memorandum report October 1983-October 1984.** Satyanarayana, P.; Ganguli, G.; Ossakow, S.L. (Naval Research Lab., Washington, DC (USA)). 5 Jul 1984. 30p. (NRL-MR—5345). NTIS, PC A03/MF A01.

The effects of magnetic shear on the collisional current driven ion cyclotron instability are discussed by incorporating the self-consistent magnetic shear produced by the currents driving the instability itself.

11748 **(N—84-28847) Further analysis of plasma bursts in high-latitude boundary layer of earth.** Omelchenko, A.N.; Vaysberg, O.L.; Rassell, K.T. (Joint Publications Research Service, Arlington, VA (USA)). Jun 1984. 2p. NTIS, PC A07.

Prognoz 7 and 8 observations of dispersed plasma bursts beneath the magnetopause in the high latitude boundary layer of the earth were examined. These bursts were observed in the magnetotail in periods when a developed plasma mantle was absent. The plasma penetrates from a transition region to a region beneath the magnetopause as the result of the reconnection of force lines of the interplanetary magnetic field and tail lines of the earth dipole.

11749 **(N—84-30962) Some contributions to knowledge of the magnetospheric plasma by ISEE investigators.** Ogilvie, K.W. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). Jun 1984. 35p. (NASA-TM—86124). NTIS, PC A03/MF A01.

The ISEE project has made substantial contributions to the knowledge of the magnetosphere during the period of the IMS, especially in the discipline of Space Plasma Physics. Results obtained during approximately the first two years of the operation of ISEE-1 and -2, and touches on relevant results of ISEE-3 are reviewed. The ability to control the separation between ISEE-1 and -2, which are in nearly identical orbits, has permitted study of the motion and structure of the bow shock and magnetopause, the boundary layers, and the plasma sheet. Much evidence was obtained favoring the existence of reconnection and its relevance to the transfer of magnetic flux from the frontside to the rear of the magnetosphere, although not everyone agrees that it is the only important process. The presence of both reflected and accelerated particles was shown to lead

to the development of a foreshock region between the bow shock and the interplanetary magnetic field line tangential to it.

11750 Large scale flow in the dayside magnetosheath. Crooker, N.U.; Siscoe, G.L.; Eastman, T.E.; Frank, L.A.; Zwickl, R.D. (Department of Atmospheric Sciencs, University of California, Los Angeles). *Journal of Geophysical Research;* **89**: No. A11, 9711-9719(1 Nov 1984).

The degree of control over plasma flow direction exerted by the compressed magnetic field in the dayside magnetosheath is examined by comparing ISEE 1 LEPEDEA data with hydrodynamic and magnetohydrodynamic predictions. Measured flow directions projected toward the subsolar region pass within ~1 R/sub E/ of the aberrated theoretical hydrodynamic stagnation point in 11 of 20 cases analyzed. The remaining nine cases pass within ~2-3 R/sub E/ of the stagnation point. One case with large deflection has been studied in detail with large-time-resolution plasma and magnetic field data both from ISEE 1 and from ISEE 3, in the role of a solar wind monitor. The deflected flow is persitent over a period of 1 1/2 hours, and its direction is consistent with a stagnation point displacement resulting from increased, asymmetric magnetic field pressure contributions during periods of low Alfven Mach number, as predicted by Russell et al. Of the other eight cases with large deflections, four are associated with flux transfer events identified independently by Berchem and Russell. The observed deflections in these cases are consistent with either the subsolar merging line or the antiparallel merging hypothesis, but not exclusively with one or the other. The results relating to the formation of a stagnation line rather than a stagnation point are inconclusive.

11751 Simultaneous observation of the plasma sheet in the near earth and distant magnetotail: ISEE-1 and ISEE-3. Scholer, M.; Hovestadt, D.; Klecker, B.; Baumjohann, W.; Gloeckler, G.; Ipavich, F.M.; Baker, D.N.; Zwicki, R.D.; Tsurutani, B.T. (Max-Planck-Institut f. Physik u. Astrophysik, Inst. f. extraterr. Physik, 8046 Garching, FRG). *Geophysical Research Letters;* **11**: No. 10, 1034-1037(Oct 1984).

We present particle data from the spacecraft 1981-025 and 1982-019 at geosynchronous orbit (6.6 R/sub E/) from ISEE-1 in the near-earth geomagnetic tail and from ISEE-3 in the distant geomagnetic tail at ~130 R/sub E/ obtained during the first half of March 22, 1983. The spacecraft observations are supplemented by ground-based magnetograms from near local-midnight stations. Two substorm particle injections were detected at ~0715 and 0.806 UT at geosynchronous orbit. At the same time suprathermal plasma sheet protons are observed at ISEE-1. Multiple entries and exits into and out of the plasma sheet are recorded at ISEE-3 in the distant tail. A substorm recovery is indicated by a poleward leap of the substorm electrojet at 0900 UT. After 0900 UT ISEE-1 and ISEE-3 entered the plasma sheet simultaneously within a few minutes. At the boundary of the recovery plasma sheet strong earthward streaming (ISEE-1) and tailward streaming (ISEE-3) suprathermal protons are observed, indicating that the two spacecraft were on opposite sides of the particle source. This represents the first measurement of ion beams at the plasma sheet boundary occurring simultaneously in the near-earth region and in the deep tail flowing in opposite directions.

11752 Detailed examination of a plasmoid in the distant magnetotail with ISEE 3. Hones E.W. Jr.; Birn, J.; Baker, D.N.; Bame, S.J.; Feldman, W.C.; McComas, D.J.; Zwickl, R.D.; Slavin, J.A.; Smith, E.J.; Tsurutani, B.T. (University of California, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Geophysical Research Letters;* **11**: No. 10, 1046-1049(Oct 1984).

A detailed description of a plasmoid is presented on plasma electron data, energetic particle data, and magnetic field data from ISEE 3. The plasmoid, 75-150 R/sub E/ long, traveling tailward at 500-1000 km/sec, appeared at ISEE 3, ~220 R/sub E/ down-tail, 27 minutes after a very strong intensification of the auroral electrojet was recorded at several ground stations. The plasmoid was overlaid by a "separatrix layer" within which energetic particles, probably originating at a near-earth reconnection region, streamed freely tailward along the field lines, the slower particles being encountered deeper within the layer. The plasmoid contained plasma of uniformly high temperature and its boundary was $<$ or $\approx$1 R/sub E/ thick.

11753 Plasma wave spectra near slow mode shocks in the distant magnetotail. Scarf, F.L.; Coroniti, F.V.; Kennel, C.F.; Smith, E.J.; Slavin, J.A.; Tsurutani, B.T.; Bume, S.J.; Feldman, W.C. (TRW Space and Technology Group, Redondo Beach, California 90278). *Geophysical Research Letters;* **11**: No. 10, 1050-1053(Oct 1984).

Recently Feldman et al (1984), used ISEE-3 data to analyze variations in charged particle and magnetic field characteristics near plasma sheet boundaries in the distant magnetotail and they demonstrated that several of the crossings had the properties of slow mode shocks. Here we discuss ISEE-3 plasma wave measurements at two of these crossings, and show that all conventional characteristics of fast collisionless shock spectra are present. Upstread (lobe side) electron plasma oscillations are detected in association with electron heat flux enhancements, and pronounced spectral peaks at lower frequencies are found within the shock layer.

11754 Slow mode shocks in the earth's magnetotail: ISEE-3. Smith, E.J.; Slavin, J.A.; Tsurutani, B.T.; Feldman, W.C.; Bame, S.J. (Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California 91109). *Geophysical Research Letters;* **11**: No. 10, 1054-1057(Oct 1984).

High time resolution magnetic field measurements adjacent to the boundary of the distant magnetotail plasma sheet have been analyzed. The nature of the changes in the field between the lobe and the plasma sheet is consistent with the boundary being a slow mode shock. The crossing times are relatively long (~ 30 sec) implying a shock thickness estimated to be approximately 10^3 km. An increase in the entropy of the electrons is consistent with dissipation at the shock. Reasonable shock normal directions are derived and may be used to determine the location of the spacecraft relative to the reconnection or merging region. It is suggested that a foreshock exists in which upstream wave and particle phenomena are occurring.

11755 Power dissipation at slow-mode shocks in the distant geomagnetic tail. Feldman, W.C.; Baker, D.N.; Bame, S.J.; Birn, J.; Jr., E.W.H.; Tokar, R.L.; Schwartz, S.J. (University of California, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Geophysical Research Letters;* **11**: No. 10, 1058-1061(Oct 1984).

ISEE-3 plasma and field data were analyzed to estimate the power dissipated across slow-mode shocks in the distant geomagnetic tail. A set of 26 unambiguous examples of slow-mode shocks encountered by ISEE 3 near X(GSM)roughly-equal-200 R/sub E/ was used for this purpose. The analysis yielded an average cross-tail electric field of 1.6 +- 0.7 mV/m an upstream Alfven Mach number of 0.19 +- 0.08 and a decrease in the Poynting flux at the shocks of 9.2 +- 7.4 x 10^{-3} ergs/cm^2/s. Assuming a mean cross-tail potential of 70 keV and a location of the neutral line near X(GSM)roughly-equal-100 R/sub E/, the average power dissipated tailward of the neutral line from lobe magnetic energy density to plasma sheet convection is 5 x 10^{18} ergs/s, a value comparable to the total power dissipated near the earth during moderate-strength substorms.

11756 Plasma entry into the distant tail lobes: ISEE-3. Gosling, J.T.; Baker, D.N.; Bame, S.J.; Hones E.W. Jr.; McComas, D.J.; Zwickl, R.D.; Slavin, J.A.; Smith, E.J.; Tsurutani, B.T. (University of California, Los Alamos National Laboratory). *Geophysical Research Letters;* **11**: No. 10, 1078-1081(Oct 1984).

ISEE-3 measurements indicate that a broad mantle-like boundary layer plasma often exists within the distant geomagnetic tail lobes at all latitudes, directly adjacent to the tail magnetopause. The presence of this boundary layer at large tail distances indicates that plasma from the magnetosheath often crosses the magnetopause locally along much of the length of the tail, and is evidence that the tail is "open."

11757 **Magnetospheric ions and electrons in the distant magnetoshearth at ~50 R/sub E/ and ~180 R/sub E/: ISEE-3 observations.** Scholer, M.; Hovestadt, D.; Klecker, B.; Gloeckler, G.; Ipavich, F.M.; Zwicki, R.D. (Max-Planck-Institut fuer Physik und Astrophysik, 8046 Garching, FRG). *Geophysical Research Letters;* **11**: No. 10, 1098-1101(Oct 1984).

We have analyzed energetic electron (75-115 keV) and proton (~30 KeV) measurements at the dawn side of the distant magnetosheath at ~50 R/sub E/ and ~180 R/sub E/. The data have been obtained during the recent ISEE-3 Geotail Mission. At ~50 R/sub E/ electronis and protons occur almost simultaneousy in bursts of ~2 min duration. The electrons stream intensely away from the general magnetopause positions along the magnetic field line. The proton angular distributions exhibit a large parallel anisotropy that is symmetric with respect to the magnetic field in the plasma frame of reference. At ~180 R/sub E/ almost no electrons have been so far observed above the threshold of our detector. The protons are isotropic in the plasma frame. The observations are discussed in terms of a possible model where magnosheath flux tubes are connected to the tail magnetic field so that the magnetospheric particles can leak out. At ~ 50R/sub E/ propagation to the spacecraft is believed to be scatter-free; after reaching ~200 R/sub E/ the particles have resided long enough in the magnetosheath so that they are then coupled to the magnetosheath flow via pitch angle scattering.

11758 **Drift mirror mode waves in the distant (X = 200 R/sub e/) magnetosheath.** Tsurutani, B.T.; Smith, E.J.; Richardson, I.G.; Lepping, R.P.; Jones, D.E.; Zwicki, R.D.; Bame, S.J. (Jet Propulsion Laboratory, C.I.T., Pasadena, California 91109). *Geophysical Research Letters;* **11**: No. 10, 1102-1102(Oct 1984).

Drift mirror waves have been detected 207 R/sub e/ downstream in the distant magnetosheath by instrumentation onboard ISEE-3. The MHD structures have estimated scale sizes of 4.6 x 10^4 to 2.3 x 10^5 km or 130 to 700 proton gyro-radii, assuming 1 keV protons. Simultaneous measurements on IMP-8 indicate that at the time of the events, the earth's magnetosphere was enveloped by a solar flare-associated interplanetary shock and driver gas. The (shocked) driver gas was characterized by an unusually low plasma density with a Beta (plasma pressure/magnetic pressure) of ~0.2. From the instability criterion, β/sub perpendicular//β/sub parallel/ >1/β/sub perpendicular/, the magnetosheath plasma should not go mirror-mode unstable unless the anisotropy, β/sub perpendicular//β_{11} is large, >6. These unusual conditions are met by the demonstrated presence of highly anisotropic, energetic 35—384 keV ions with P/sub perpendicular//P_{11}roughly-equal30. It is calculated that most of the plasma energy density can be due to >1 keV ions. The source of the ions is not well understood, but an appealing possibility is magnetic annihilation of the northward magnetosheath fields with southern hemisphere polar cusp magnetic fields.

6403 Atomic, Molecular, And Chemical Physics

REFER ALSO TO CITATION(S) 64030011438, 11538, 11551, 11898

11759 **(BNL—35312) Investigations of molecular orbitals with accel-decel beams.** Meron, M.; Johnson, B.M.; Jones, K.W.; Schuch, R.; Schmidt-Boecking, H.; Tserruya, I. (Brookhaven National Lab., Upton, NY (USA); Heidelberg Univ. (Germany, F.R.). Physikalisches Inst.; Frankfurt Univ. (Germany, F.R.). Inst. fuer Kernphysik; Weizmann Inst. of Science, Rehovoth (Israel)). Sep 1984. Contract AC02-76CH00016. 19p. (CONF-841117—29). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005128.

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

Quasimolecular transition energies can be found directly from the impact-parameter dependence of interference structure observed in measured K x-ray spectra. As these experiments require a K-vacancy bearing projectile at collision velocities small compared to the equivalent K-shell electron velocity, the accel-decel technique has to be used. Such an experiment was performed at the BNL Tandem Accel-Decel Facility for collisions of Cl^{10+} with Ar at energies ranging from 2.5 to 20 MeV. A new method of analysis using the uniform asymptotic approximation is described here. Quasimolecular transition energies derived using this method are compared to results of a previous analysis based on the determination of the relative positions of maxima and minima in the interference patterns. 6 references, 3 figures.

11760 **(BNL—35550) Large-angle positronium emission for Al(110).** Schultz, P.J.; Lynn, K.G.; Frieze, W.E. (Brookhaven National Lab., Upton, NY (USA); University of Western Ontario, London (Canada). Dept. of Physics). Oct 1984. Contract AC02-76CH00016. 17p. (CONF-8406228—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004700.

From International workshop on slow positrons in surface science; Pajulahti, Finland (25 Jun 1984).

Mono-energetic positrons have been used to study the time-of-flight distribution of ortho-positronium (o-Ps) formed just outside the surface of an Al(110) single crystal. The data are interpreted in terms of two predominant angular distributions for the directly formed o-Ps: one that is peaked towards the surface normal and another that is directed towards large angles. These processes are shown to be very sensitive to both oxygen exposure and Ar^+ ion sputtering. Ps emitted at large-angles may be evidence of formation with electrons propagating in a two-dimensional surface state.

11761 **(BNL—35573) Positron reemission: measurement of thin single crystal W(100) films to be used as transmission moderator or re-moderators.** Chen, D.M.; Lynn, K.G.; Pareja, R.; Nielsen, B. (Brookhaven National Lab., Upton, NY (USA)). Nov 1984. Contract AC02-76CH00016. 18p. (CONF-8406228—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005133.

From International workshop on slow positrons in surface science; Pajulahti, Finland (25 Jun 1984).

It has been shown that one can produce thin single crystal W films capable of reemitting positrons at a sufficiently high fraction to be used either as a moderator or as a re-moderator. Both the impurities and the defects could be removed by the appropriate cleaning and annealing procedures, and narrow beam emission could be attained when the films were cleaned. This technique would also be a good method for characterizing defect concentration at interfaces or in thin films.

11762 **(CONF-841117—37) Effect of the chemical environment on the L and M heavy-ion-induced x-ray satellite emission spectra.** Rosseel, T.M.; Dale, J.M; Hulett, L.D.; Krause, H.F.; Pepmiller, P.L.; Raman, S.; Vane, C.R.; Young, J.P. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005259.

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

High-resolution measurements of L and M, heavy-ion-induced x-ray satellite emission (HIXSE) spectra have been obtained for several intermediate and high Z targets. Variations in the intensity profile of these satellite lines were observed for different chemical compounds and alloys. Although these spectra are more complex than the K/sub α/, select regions of the satellite spectra can be correlated with parameters describing the chemical environment of the emitting target atom. These results indicate that HIXSE can probe the chemical nature of intermediate and high Z materials. The effect of projectile energy on the L x-ray satellites is also discussed. 7 references, 4 figures, 1 table.

11763 **(CONF-841117—40) Ultrahigh-resolution studies of heavy-ion-induced x-ray satellite emission.** Vane, C.R.; Kaellne, E.; Kaellne, t.; Morford, G.; Raman, S.; Smith, M.S. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005266.

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

We studied K/sub α/ X-ray emission from sulfur compounds and L X-ray emission from molybdenum metal induced by 34 MeV Cl/sup q^+/ ion bombardment. The measurements were made with an energy resolution high enough to observe the principal multiplet

components within the various satellite groups. The data were taken with a narrow-bandwidth, very-high-resolution, Van Hamos curved-crystal spectrometer using a position sensitive detector. The sulfur spectra display ~ 1-eV fine structures which differ markedly for the various targets. Even in these preliminary studies, the data show promise for yielding new information for chemical analysis. To continue to progress in this area, we have designed and are constructing a new, more versatile Van Hamos spectrometer. 25 references, 4 figures.

11764 **(DOE/ER/10431—1) Interaction of low energy electrons with surface lattice vibrations. Final report.** Tong, S.Y. (Wisconsin Univ., Milwaukee (USA)). 5 Nov 1984. Contract AC02-79ER10431. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005475.

In carrying out the DOE contract, we have succeeded in constructing a new microscopic theory, with multiple scattering, for the inelastic scattering of electrons by surface vibrations. We have applied the theory to detailed studies of angle and energy variations of the inelastic cross-section for two important systems in surface physics: carbon monoxide molecules adsorbed on the (100) surface of a nickel crystal, and hydrogen atoms adsorbed on a reconstructed tungsten (100) surface. These calculations have outlined general trends that we expect to apply to a wide variety of systems. Also, we have discovered a series of new selection rules that apply to off-specular scattering. Particularly interesting are pseudo-selection rules which are not group theoretical in origin, but approximate statements that hold well when the electron scattering amplitude exhibits a slow energy variation. We have found and defined conditions for which these selection rules would hold and break down.

11765 **(DOE/ER/13041—T2) Turbulence and the distortion of reactions. Progress report, September 1, 1983-September 1, 1984.** Johnson, J.A. III. (City Coll., New York (USA). Dept. of Physics). 1984. Contract AC02-83ER13041. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004885.

We have obtained useful preliminary results and a confirmation of our analytical techniques on the distortion of reactions in a nonequilibrium system similar to the N_2O_4 reversible $2NO_2$ which we will study in the pressure driven shock tube. Using the turbulence in a shock-wave induced plasma, we can show that the imposition of a magnetic field parallel to the direction of the flow reduces the dimensionality of the unstable system. This is analogous to the onset of relaxation effects in our target system. We show the correlation profiles from ion probes outside the region of the magnetic field for two cases of turbulent flow. In the first case, the magnetic field was turned off; in the second case it was turned on. In both cases, there is no apparent effect. Similar data are shown for ion probes inside the coils and the distorting effect of the magnetic field is clear. Figures 3 and 4 make the same kind of comparisons of frequency spectra with similar results. These data show a coupling of the imposed magnetic field such that a shift toward higher characteristic frequencies is produced. This implies, conversely, a potentially important frequency sensitivity in reacting systems which are to be influenced by turbulence.

11766 **(DOE/ER/13237—T1) Low energy ion-neutral collisions. Progress report, June 1, 1984-May 31, 1985.** Leventhal, J.J. (Missouri Univ., St. Louis (USA)). Nov 1984. Contract FG02-84ER13237. 12p. (COO—2718-12). NTIS, PC A02/MF A01; GPO Dep. File Number DE85004884.

In one set of experiments a subject of some controversy, the production of ions in sodium vapor irradiated by pulsed laser light at near D-line wavelengths, was examined and the controversy resolved. Our new results corroborated our previous findings and verified our original interpretation that these ions arise from the neutral dimer component of the vapor. In a separate set of experiments reactive processes involving highly excited atomic reactants were studied.

11767 **(GSI—84-43(Prepr.)) Positron spectroscopy of supercritical heavy ion collision systems.** Bokemeyer, H. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Jul 1984. 37p. (CONF-8404157—3). NTIS (US Sales Only), PC A03/MF A01. File Number DE85750271.

From 19. winter school on physics; Zakopane, Poland (3 Apr 1984).

Narrow peak structures at proportional 300 keV have been observed in the positron spectra of supercritical collision systems. There remains only little possibility that these structures can be associated with nuclear deexcitation of the separated collision products. Emitted from systems both existing for $>10^{-20}$ sec and apparently moving with the velocity of the center of mass these positrons may represent candidates for the process of spontaneous positron emission from metastable di-nuclear quasiatoms although straight-forward scaling of supercritical binding with the combined charge of the colliding nuclei does not agree with the observed energies.

11768 **(LA-UR—84-3805) Use of markers to elucidate reacting sputtering processes.** Springer, R.W.; McCreary, W.J.; Cordi, R.C. (Los Alamos National Lab., NM (USA)). 1984. Contract W-7405-ENG-36. 19p. (CONF-841218—20). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005723.

From 31. national vacuum symposium; Reno, NV, USA (3 Dec 1984).

The reactive gases of nitrogen, ammonia, carbon monoxide and methane were introduced to a steady state deposition of aluminum using a planar magnetron operating at ~ 400 volts. As soon as the plasma was found to change color, the deposition was terminated and the gases pumped out. A marker of copper was deposited on the substrate. Argon was re-introduced to the chamber and sputtering continued. In this fashion, the effect of the compound formed at the target was separated from the plasma/substrate effects. The resulting films were analyzed by Auger Depth Profiling. The marker experiments show a decoupling of the target and plasma/substrate interaction within the sputter etch rate and doping time constraints. The data show clear evidence for the deposition of compound from the target which is thought to be due to the near surface modification from the cathode fall voltage. The energy partitioning of the carbon in either carbon monoxide or methane yields the expected results, namely that the deeper the implant, the greater the portion of carbon from the target. The nitrogen and ammonia results were similar in nature due to the reduced voltage from the sputter power supply. The results are still consistent with the target being doped, in that the nitrogen ranges in the target are essentially identical. In conclusion, this experiment does not prove that all the compound is formed and sputtered from the target, but does indicate that a significant fraction is formed and sputtered from the target. The data are consistent with a model which indicates that the reactive species is implanted in the target, subsequently eroded away and contributes to the observed compound films. 12 references, 4 figures.

11769 **(PB—84-224021) Impact of atomic physics on fundamental constants. Final report.** Deslattes, R.D. (National Bureau of Standards, Washington, DC (USA)). 1983. 21p. Pub. in Proceedings of Int. Conference Atomic Physics (8th), Goteborg, Sweden, August 2-6, 1982, Atomic Physics 8, p22-42 1983.

Atomic physics determinations of numerical values involves the study of calculable spectra. In the case of hydrogen, inversion of the theoretical expressions for fine structure and hyperfine structure were used to obtain alpha, however their utility depends on the status of theory and experiment as well as on the availability of alternative approaches. Another group of measurements exploit the properties of macroscopic quantum mechanical systems. Among these on the electrical side, the Josephson frequency voltage relationship in superconductors has already a long and productive history. Other related effects such as flux quantization (as a route to the Compton wavelength) have yet to yield results commensurate with their promise. Finally, there remains a family of measurements which are both macroscopic and classical. These seem to be un-

avoidable thus far and continue to represent the least tractable problems encountered in this area of work.

11770 **Photoionization study of HgAr.** Linn, S.H.; Brom J.M. Jr.; Tzeng, W.; Ng, C.Y. (Ames Labortory, U.S. Department of Energy and Department of Chemistry, Iowa State University, Ames, Iowa 50011). *Journal of Chemical Physics;* **82**: No. 2, 648-652(15 Jan 1985).

Photoionization efficiency data for $HgAr^+$ have been obtained in the region of 680—1240 A. The ionization energy of HgAr was determined to be 10.217 +- 0.012 eV. This value allows the calculation of the dissociation energy of $HgAr^+$ to be 0.228 +- 0.017 eV. The relative probabilities for the formation of $HgAr^+$ via the reactions Ar* x Hg or Hg* x Ar→ $HgAr^+ + e^-$ with Ar* and Hg* prepared in high Rydberg states in the energy range of 10.22—15.79 eV were estimated. Although the radii for the 3d and 5s Rydberg ortitals of Ar have similar values, the probabilities for the formation of $HgAr^+$ from Hg x Ar* with Ar* in the $5s[3/2]^0_1$ and $5s'[1/2]^0_1$ Rydberg states are substantially greater than those when the Ar* excited atoms are in the $3d[1/2]^0_1$, $3s[3/2]^0_1$, and $3d'[3/2]^0_1$ Rydberg levels. The ratio for the cross sections for the formation of $HgAr^+$ from Hg x Ar* with Ar* formed in the $3d[1/2]^0_1$ and $4d[1/2]^0_1$ states, as well as that with Ar* prepared in the $5d[1/2]^0_1$ and $6d[1/2]^0_1$ states, were found to be consistent with the predictions of the previous impact parameter calculations.

11771 **Photoelectron angular distributions from resonant multiphoton ionization of atomic carbon.** Pratt, S.T.; Dehmer, J.L.; Dehmer, P.M. (Argonne National Laboratory, Argonne, Illinois 60439). *Journal of Chemical Physics;* **82**: No. 2, 676-680(15 Jan 1985). Contract W-31-109-ENG-38.

Atomic carbon in both the ^3P ground state and the ^1D first excited state is prepared by UV multiphoton dissociation of carbon tetrachloride. Photoelectron angular distributions were obtained following two photon resonant, three photon ionization via the 3p $^1S_0 \leftarrow {}^1D_2$ transition using linear polarized light and via the 3p $^3D_2 \leftarrow {}^3P_0$ transition using both linear and circular polarized light. The results illustrate that resonant multiphoton ionization of atomic carbon must be discussed in terms of the complex atom, and not within a single electron framework.

11772 **Pulse expansion deposits and orientational ordering for low temperature matrices.** Jones, L.H.; Ekberg, S.A.; Swanson, B.I. (Los Alamos National Laboratory, University of California, Los Alamos, New Mexico 87545). *Journal of Chemical Physics;* **82**: No. 2, 1055-1056(15 Jan 1985).

Low temperature matrices of SF_6 in xenon were prepared by pulsed expansion of premixed gas through a conical 0.5 mm orifice onto a cold window. Infrared polarization studies were made of the orientational ordering exhibited by the ν_3 mode at ~933 cm^{-1}. The orientational ordering was similar to that of big pulse deposits at 40 K and below but less for 50 K deposits. The pronounced polarization observed suggests an anomaly in the refractive index of the matrices prepared by this technique. For deposits at 50 K, aggregation is found to be negligible for pulsed expansion while it is significant for large pulse deposits, and even greater for the slow-spray-on technique.

11773 **Effect of temperature on nondissociative electron attachment to perfluorobenzene.** Spyrou, S.M.; Christophorou, L.G. (Atomic, Molecular and High Voltage Physics Group, Health and Safety Research Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Journal of Chemical Physics;* **82**: No. 2, 1048-1049(15 Jan 1985).

Experiments are reported for the rate constants for electron attachment to perfluorobenzene in the temperature range 400 to 650 K. It is found that the rate constant actually decreases by more than two orders of magnitude when T is increased from 400 to 650 K. (AIP)

11774 **Excitation of edge modes in the interaction of electron beams with dielectric wedges.** Garcia-Molina, R.; Gras-Marti, A.; Ritchie, R.H. (Laboratori de Capes Fines i Colisions Atomiques, Departament de Fisica, Facultat de Ciencies, Universitat d'Alacant, Apartat 99, E-03080 Alacant/Alicante, Spain). *Physical Review [Section] B: Condensed Matter;* **31**: No. 1, 121-126(1 Jan 1985).

Recent experimental data on electron-energy-loss spectrometry of the interaction between small crystallites and beams traveling at a fixed beam-solid surface distance are analyzed in terms of the surface and bulk excitation modes of parabolically shaped wedges. The probability of excitation of the surface modes is calculated, in the nonretarded limit, for an electron traveling parallel to the wedge surface, either outside or inside the dielectric wedge. The main features of available experimental data for MgO crystallites can be explained by the theory.

11775 **Nonclassical behavior of energy transfer from molecules to metal surfaces: Biacetyl($^3n\pi^*$)/Ag(111).** Alivisatos, A.P.; Waldeck, D.H.; Harris, C.B. (Department of Chemistry and Materials and Molecular Research, Division of Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Journal of Chemical Physics;* **82**: No. 1, 541-547(1 Jan 1985).

The distance dependent lifetime of biacetyl separated from a Ag(111) crystal by NH_3 spacer layers ranging in thickness from 28 to 457 A has been measured. We extended previous work, where the molecular emission was resonant with the silver interband/plasmon transition, to the case where the emission is below the interband transition. The modulation of the radiative rate is described inadequately by the classical theory for our experimental geometry. At short distances where nonradiative energy transfer to the metal is important, the classical prediction deviates from the data as well. These observations are consistent with a model in which energy is transferred to electrons localized at the metal surface but might also be explained by an inability of the classical theory to model the radiative rate properly.

11776 **Harmonic tunneling corrections to sudden and adiabatic transition state theory.** Pollak, E. (Department of Chemistry, University of California, Berkeley, California 94720). *Journal of Chemical Physics;* **82**: No. 1, 106-112(1 Jan 1985).

Harmonic tunneling corrections are incorporated within semiclassical adiabatic and sudden transition state theory. Good agreement is obtained with CS and sudden quantal computations. Analysis of the transition state theories at the level of rotationally averaged cross sections leads to a new interpretation of the quantal sudden computation and to convergence of the adiabatic and sudden approximations in reactive scattering.

11777 **Wave packet approach to inelastic scattering from large targets.** Drolshagen, G.; Heller, E.J. (Theoretical Division, T-12, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Chemical Physics;* **82**: No. 1, 226-235(1 Jan 1985).

A theoretical approach to collision-induced energy transfer is presented that allows the direct calculation of the translational energy distribution of the separating fragments. Many features of the method are in close analogy to actual time-of-flight measurements. The energy spectrum can be calculated with high or low resolution and the target states are not explicitly used. In this study, a semiclassical implementation, using Gaussian wave packets, is applied to collinear scattering from an harmonic chain of variable length. Scattering intensities as functions of the final translational energy are calculated and analyzed for various chain lengths and different projectile masses. Results are reported for free chains and for those where an additional potential forces the atoms to a local motion around their equilibrium positions. In addition a "frozen" approximation to the wave packet approach is successfully tested. This "frozen Gaussian" approximation may have a wide field of possible applications, as it requires only slightly more computational effort than a pure classical calculation and yet describes many quantum effects correctly. Furthermore, the chain model is used to examine possible applications of the wave packet approach to in-

elastic gas—surface scattering. Results are reported for a chain of 40 atoms, which should allow an extrapolation to an infinite chain, and for a ten-atom damped oscillator. A target autocorrelation formula is rederived and found to be very useful in explaining many of the structures seen in the spectra.

11778 **Ab initio effective core potentials for molecular calculations. Potentials for the transition metal atoms Sc to Hg.** Hay, P.J.; Wadt, W.R. (Theoretical Division, MS J569, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Chemical Physics;* **82**: No. 1, 270-283(1 Jan 1985).

Ab initio effective core potentials (ECP's) have been generated to replace the Coulomb, exchange, and core-orthogonality effects of the chemically inert core electron in the transition metal atoms Sc to Hg. For the second and third transition series relative ECP's have been generated which also incorporate the mass—velocity and Darwin relativistic effects into the potential. The ab initio ECP's should facilitate valence electron calculations on molecules containing transition-metal atoms with accuracies approaching all-electron calculations at a fraction of the computational cost. Analytic fits to the potentials are presented for use in multicenter integral evaluation. Gaussian orbital valence basis sets are developed for the (3d,4s,4p), (4d,5s,5p), and (5d,6s,6p) orbitals of the first, second, and third transition series atoms, respectively. All-electron and valence-electron atomic excitation energies are also compared for the low-lying states of Sc—Hg, and the valence-electron calculations are found to reproduce the all-electron excitation energies (typically within a few tenths of an eV).

11779 **Ab initio effective core potentials for molecular calculations. Potentials for main group elements Na to Bi.** Wadt, W.R.; Hay, P.J. (Theoretical Division, MS J569, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Chemical Physics;* **82**: No. 1, 284-298(1 Jan 1985).

A consistent set of ab initio effective core potentials (ECP) has been generated for the main group elements from Na to Bi using the procedure originally developed by Kahn. The ECP's are derived from all-electron numerical Hartree—Fock atomic wave functions and fit to analytical representations for use in molecular calculations. For Rb to Bi the ECP's are generated from the relativistic Hartree—Fock atomic wave functions of Cowan which incorporate the Darwin and mass—velocity terms. Energy-optimized valence basis sets of (3s3p) primitive Gaussians are presented for use with the ECP's. Comparisons between all-electron and valence-electron ECP calculations are presented for NaF, NaCl, Cl_2, Cl_2^-, Br_2, Br_2^-, and Xe_2^+. The results show that the average errors introduced by the ECP's are generally only a few percent.

11780 **Ab initio effective core potentials for molecular calculations. Potentials for K to Au including the outermost core orbitals.** Hay, P.J.; Wadt, W.R. (Theoretical Division, MS J569, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Chemical Physics;* **82**: No. 1, 299-310(1 Jan 1985).

Ab initio effective core potentials (ECP's) have been generated to replace the innermost core electron for third-row (K—Au), fourth-row (Rb—Ag), and fifth-row (Cs—Au) atoms. The outermost core orbitals: corresponding to the ns^2np^6 configuration for the three rows here: are not replaced by the ECP but are treated on an equal footing with the nd, (n+1)s and (n+1)p valence orbitals. These ECP's have been derived for use in molecular calculations where these outer core orbitals need to be treated explicitly rather than to be replaced by an ECP. The ECP's for the forth and fifth rows also incorporate the mass—velocity and Darwin relativistic effects into the potentials. Analytic fits to the potentials are presented for use in multicenter integral evaluation. Gaussian orbital valence basis sets are developed for the (3s, 3p, 3d, 4s, 4p), (4s, 4p, 4d, 5s, 5p), and (5s, 5p, 5d, 6s, 6p) ortibals of the three respective rows.

11781 **Resonant electron transfer and excitation in two, three, and four electron sub20Casupq+ and sub23Vsupq+ ions colliding with helium.** Tanis, J.A.; Bernstein, E.M.; Graham, W.G.; Stockli, M.P.; Clark, M.; McFarland, R.H.; Morgan, T.J.; Berkner, K.H.; Schlachter, A.S.; Stearns, J.W. (Department of Physics, Western Michigan University, Kalamazoo, Michigan 49008). *Physical Review Letters;* **53**: No. 27, 2551-2554(31 Dec 1984). Contract AC02-83ER13116.

Significant new evidence is reported for resonant transfer and excitation in ion-atom collisions. This process, which is analogous to dielectronic recombination, occurs when a target electron is captured simultaneously with the excitation of the projectile followed by photon emission. It was investigated for collisions of 100—360-MeV sub20Casup16+,17+,18+ and 180—460-MeV sub23Vsup19+,20+,21+ with He by measurement of the cross section for projectile K x rays coincident with single electron capture. For both collision systems, strong resonant behavior with structure is observed in the coincidence cross section in agreement with theoretical calculations.

11782 **Electron bombardment enhancement of the reactivity of graphite with atomic hydrogen: Threshold-like effects.** Brice, D.K.; Ashby, C.I.H. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Journal of Chemical Physics;* **81**: No. 12, 6244-6248(20 Dec 1984). Contract AC04-76DP00789.

The chemical reactivity of graphite surfaces exposed to atomic hydrogen is enhanced under electron bombardment by an enhancement factor ϵ' which depends on the incident electron energy. A sharp threshold-like increase in ϵ' is observed for crystalline graphite at an energy E/sub th/ which depends on the angle of incidence θ of the electron beam with respect to the basal-plane surface normal. Measurements of the dependence of E/sub th/ on θ are reported here. Model calculations indicate that the effect is due either to a direct excitation of the electronic transition responsible for the enhancement or to plasmon production which subsequently drives the transition. Further experiments are suggested to distinguish between these mechanisms.

11783 **Use of alpha hyperfine coupling tensors as a measure of unpaired spin density and free radical geometry.** Bernhard, W.A. (Department of Radiation Biology and Biophysics, University of Rochester, Rochester, New York 14642). *Journal of Chemical Physics;* **81**: No. 12, 5928-5936(20 Dec 1984).

The dipolar elements (B/sub x/, B/sub y/, B/sub z/) of the α-hydrogen hyperfine coupling tensor (/sup α/A) are used to calculate unpaired spin density (rho) and bond lengths (R/sub H/) by using the two center dipole equations derived by Gordy (Ref. 1). B/sub z/ is used as a measure of rho in the equation B/sub z/ = Q/sup dip//sub z/ rho with Q/sup dip//sub z/ = 38.7 MHz. The /sup α/H-C bond length of electron gain π radicals and alkyl radicals are found to be 0.05—0.10 A shorter than in comparable nonradicals while in electron loss π radicals the bond lengths are longer by 0.04—0.09 A. The two center dipole formalism appears to be useful as an analytical method for distinguishing electron loss π radicals from electron gain π radicals. It is suggested that the isotropic component of /sup α/H hfc is affected by spin density β to the /sup α/H of interest, accounting for a significant portion of the variability in Q/sup H//sub CH/ in the McConnel (Ref. 2) equation, /sup α/A = Q/sup H//sub CH/rho.

11784 **Energy transfer in the collision of an atom with a cold lattice.** Riley, M.E.; Diestler, D.J. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Journal of Chemical Physics;* **81**: No. 12, 6361-6366(20 Dec 1984). Contract AC04-76DP00789.

We report numerically exact classical calculations on energy transfer and capture of an atom incident on an initially cold lattice in a collinear configuration. The lattice is harmonic and the adatom—surface interaction is a Morse potential. The system is completely specified in terms of only three physical parameters: the adatom-to-lattice-atom mass ratio, the ratio of the Morse interaction force constant to the lattice force constant, and the ratio of the inci-

dent energy to the Morse well depth (lattice—adatom binding energy). These exact calculations form a basis for comparing and testing several approximate dynamical models of gas—surface interactions.

11785 **Efficient solution of Poisson's equation in linear combination of atomic orbitals (LCAO) electronic structure calculations.** Feibelman, P.J. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Journal of Chemical Physics;* **81**: No. 12, 5864-5872(20 Dec 1984). Contract AC04-76DP00789.

An accurate and efficient method is described for the evaluation of electrostatic contributions in LCAO electronic structure calculations. The charge density rho(r) is decomposed into rho/sup(1)(r), a component whose rapid variation near any nucleus reproduces that of rho(r) to a very good approximation, and a remainder density δrho(r)equivalentrho(r)-rho/sup(1)(r), which is thereby guaranteed to be slowly varying in space. The power of the decomposition resides in the fact that rho/sup(1)(r) can be expressed exactly as a sum of one-center densities, without the use of any fit procedure. Because rho/sup(1)(r) is a sum of one-center multipolar densities, the Hartree potential is a function with a simple one-dimensional integral representation, and its matrix elements can be obtained by performing one-dimensional integrals over it. Since δrho(r) is spatially slowly varying, the Hartree potential to which it corresponds and the matrix elements of this potential can accurately be evaluated on a relatively coarse coordinate space mesh, using fast Fourier transforms. The method is illustrated via molecular structure calculations for N_2 and NH_3. The calculations are accurate to a few percent when the required integrals over δrho(r) and δV(r) are performed on a mesh of spacing 0.4 a.u. The N—N bond length and stretch frequency are found to equal 2.10 a.u. and 2.3 x 10^3 cm^{-1}, respectively. The equilibrium N—H bond length and H—N—H angle are calculated to be 1.93 a.u. and 105°, respectively, while the NH_3 inversion barrier turns out to equal 0.25 eV. These results are in good agreement with earlier calculations.

11786 **Fourier transform methods for calculating action variables and semiclassical eigenvalues for coupled oscillator systems.** Eaker, C.W.; Schatz, G.C.; De Leon, N.; Heller, E.J. (Department of Chemistry, Northwestern University, Evanston, Illinois 60201). *Journal of Chemical Physics;* **81**: No. 12, 5913-5919(20 Dec 1984).

Two methods for calculating the good action variables and semiclassical eigenvalues for coupled oscillator systems are presented, both of which relate the actions to the coefficients appearing in the Fourier representation of the normal coordinates and momenta. The two methods differ in that one is based on the exact expression for the actions together with the EBK semiclassical quantization condition while the other is derived from the Sorbie—Handy (SH) approximation to the actions. However, they are also very similar in that the actions in both methods are related to the same set of Fourier coefficients and both require determining the perturbed frequencies in calculating actions. These frequencies are also determined from the Fourier representations, which means that the actions in both methods are determined from information entirely contained in the Fourier expansion of the coordinates and momenta. We show how these expansions can very conveniently be obtained from fast Fourier transform (FFT) methods and that numerical filtering methods can be used to remove spurious Fourier components associated with the finite trajectory integration duration. In the case of the SH based method, we find that the use of filtering enables us to relax the usual periodicity requirement on the calculated trajectory. Application to two standard Henon—Heiles models is considered and both are shown to give semiclassical eigenvalues in good agreement with previous calculations for nondegenerate and 1:1 resonant systems. In comparing the two methods, we find that although the exact method is quite general in its ability to be used for systems exhibiting complex resonant behavior, it converges more slowly with increasing trajectory integration duration and is more sensitive to the algorithm for choosing perturbed frequencies than the SH based method.

11787 **Orientational ordering and site structure of SiF_4 trapped in rare gas solids.** Jones, L.H.; Swanson, B.I.; Ekberg, S.A. (Los Alamos National Laboratory, University of California, Los Alamos, New Mexico 87545). *Journal of Chemical Physics;* **81**: No. 12, 5268-5271(15 Dec 1984).

The infrared spectrum of the ν_3 mode of SiF_4 shows only one site with marked site-symmetry splitting accompanied by pronounced (>95%) orientational ordering. The results indicate a site symmetry of C/sub 3v/ with the SiF_4 molecule occupying a four-atom substitutional site with a cubic-close-packed environment. In krypton and xenon matrices, however, SiF_4 occupies a three-atom substitutional site. The fact that SiF_4 shows only one dominant site when present in argon matrices of UF_6 indicates that one of the two UF_6 sites has a local hexagonal close packed environment induced by short range stacking faults.

11788 **Torsional potential and intramolecular dynamics in the $C_2H^+_4$ photoelectron spectra.** Pollard, J.E.; Trevor, D.J.; Reutt, J.E.; Lee, Y.T.; Shirley, D.A. (Materials and Molecular Research Division, Lawrence Berkeley Laboratory, and Department of Chemistry, University of California, Berkeley, California 94720). *Journal of Chemical Physics;* **81**: No. 12, 5302-5309(15 Dec 1984).

The 584 A photoelectron spectrum of ethylene was reexamined at higher resolution using a supersonic molecular beam source for rotational cooling. The vibrational frequencies of the $C_2H^+_4X\ ^2B_3$ state were measured with improved accuracy, which permitted the torsional potential energy curve to be characterized. The measured equilibrium torsional angle is 27°*2°, and the inversion barrier is 270 +- 150 cm^{-1}. The A $^2B_3$ state is shown to be in reasonable agreement with a recent theoretical calculation which takes into account strong nonadiabatic effects. The correlation function calculated for this state is consistent with this calculation and recent calculations on the unimolecular dissociation of this state. The B ^2A state correlation function indicates a rapid decay mechanism is operative. The broadened vibrational structure in the fourth band results from a saddle point in the C $^2B_2$ potential energy surface from which the ion relaxes to the X state by moving along a repulsive degree of freedom, which in this case is internal rotation. The C state vibrational broadening as well as the decay of the correlation function yield a lifetime for this process of 7 fs.

11789 **Nitrogen K-shell photoemission and Auger emission from N_2 and NO.** Lindle, D.W.; Truesdale, C.M.; Kobrin, P.; Ferrett, T.A.; Heimann, P.A.; Becker, U.; Kerkhoff, H.G.; Shirley, D.A. (Materials and Molecular Research Division, Lawerence Berkeley Laboratory and Department of Chemistry, University of California, Berkeley, California 94720). *Journal of Chemical Physics;* **81**: No. 12, 5375-5378(15 Dec 1984).

The first gas-phase photoelectron measurements near the nitrogen K edges of N_2 and NO are reported. Shape-resonance behavior is exhibited in the cross sections for both N 1s photoemission and N KVV Auger emission. The measured cross sections agree well with absorption and electron-energy-loss results, and with Stieltjes—Tchebycheff moment-theory calculations (for N_2) except for a small energy shift. The measured asymmetry parameters for N 1s photoemission also exhibit changes in the shape-resonance region, but not as pronounced as those predicted by the multiple-scattering method (MSM). Comparison of all of the results with the MSM calculations indicates that the shape-resonance effects predicted by the MSM are higher in energy, and are narrower and more intense than those actually observed.

11790 **State-to-state vibrational excitation of I_2 in collisions with He.** Hall, G.; Liu, K.; McAuliffe, M.J.; Giese, C.F.; Gentry, W.R. (Chemical Dynamics Laboratory, University of Minnesota, Minneapolis, Minnesota 55455). *Journal of Chemical Physics;* **81**: No. 12, 5577-5585(15 Dec 1984). Contract AC02-83ER13063.

Cross sections for v = 0→1, 2, 3 excitation in I_2+He collisions have been measured over the kinetic energy range from threshold to 0.4 eV by means of a new experimental technique in which pulsed molecular beams are crossed at a variable intersection angle and scattered products are state selectively detected by laser

induced fluorescence. The values of the measured cross sections range from about 0.2 A^2 for v = 1 at 0.4 eV to about 10^{-5} A^2 for v = 3 at the low-energy detection limit. The kinetic energy dependences of the cross sections for exciting v = 1, 2, and 3 are approximately linear, quadratic, and cubic, respectively. The experimental cross sections are compared with those predicted by a simple classical model and by the detailed quantum calculations reported by Schwenke and Truhlar in the accompanying article. It appears that vibrational excitation in this system comes primarily from nearly impulsive collisions with the steeply repulsive part of the interaction potential in approximately collinear geometries. The most probable rotational excitation is small, but even very high J states are excited with small probability.

11791 **Study of the symmetric charge transfer reaction H^+Z+H_2 using the high resolution photoionization and crossed ion—neutral beam methods.** Liao, C.; Liao, C.; Ng, C.Y. (Ames Laboratory, U. S. Department of Energy and Department of Chemistry, Iowa State University, Ames, Iowa 50011). *Journal of Chemical Physics;* **81**: No. 12, 5672-5691(15 Dec 1984). Contract W-7405-ENG-82.

A new ion—molecule reaction apparatus, which combines the crossed ion—neutral beam method, high resolution photoionization mass spectrometry, and charge transfer detection, has been developed. Using this apparatus, we have examined the relative total charge transfer cross sections of $H^+_2+H_2$ as a function of the vibrational state of H^+_2, v/sup prime/$_0$ = 0—4, at the center-of-mass collision energy (E/sub c.m./) range of 0.38—200 eV. The relative total charge transfer cross sections measured at E/sub c.m./ = 8, 16, 22.5, and 200 eV are in general agreement with a recent theoretical calculation based on the semiclassical energy conserving trajectory formulation. The vibrational energy effects on the cross sections for the charge transfer and the H^+_3+H channels at low collision energies (E/sub c.m./ < or =1 eV) were directly observed. The rotational states, J = 0, 1, and 2, of H^+_2(v/sup /$_0$ = 0) were also selected in this experiment. Within experimental uncertainties, the rotational excitations of H^+_2(v/sup prime/$_0$ = 0) have no effect on the relative total charge transfer cross sections at E/sub c.m./ = 2 and 4 eV. By calibrating the nominal relative total charge transfer cross sections obtained with an ionizing photon energy of 18 eV (688 A) to absolute total charge transfer cross sections determined previously using low energy electron impact ionization, absolute total charge transfer cross sections for v/sup /$_0$ = 0 and 1 in the kinetic energy range of E/sub c.m./ = 8—200 eV were estimated. The absolute total charge transfer cross sections thus obtained for v/sup prime/$_0$ = 0 and 1 are lower than the theoretical values by approximately a factor of 2.

11792 **Laser induced fluorescence study of Xe($5p^5$6p, $5p^5$6p′, $5p^5$7p, and $5p^5$6d) states in Ne and Ar: Radiative lifetimes and collisional deactivation rate constants.** Inoue, G.; Ku, J.K.; Setser, D.W. (Department of Chemistry, Kansas State University, Manhattan, Kansas 66506). *Journal of Chemical Physics;* **81**: No. 12, 5760-5774(15 Dec 1984).

The radiative lifetimes and the collisional deactivation constants by Ne and Ar for all 6p, 6p′, 7p, and 6d states of Xe, except two, were studied by single or two-photon laser induced fluorescence in the afterglow of a pulsed discharge [the prime symbol denotes the $Xe^+(^2P_1$/sub //$_2$) core rather than the $Xe^+(^2P_3$/sub //$_2$) core]. The radiative lifetimes, 30—48 ns for 6p and 6p′ states and 68—172 ns for 7p states, agree well with theoretical values; but, the agreement between experiment and theory is less satisfactory for the 6d states. The collisional deactivation constants for Ne and Ar are similar if there is a nearby product level. However, the deactivation constants by Ar are much larger than for Ne, if there is a large energy defect for the product state. The product distributions also were measured; Ar collisions give products with larger energy defect than collisions with Ne, which tend to favor nearly isoenergetic product states. The number and type of product channels are related to the locations of crossings in the Rg—Xe potential curves and the more attractive nature of Ar—Xe* vs Ne—Xe*. There is no clear favoring between intra- and intermultiplet product states of Xe*. The radiative cascading (6p′,7p)→(7s or 4d)→6p also was studied. in Ne and Ar

11793 **Precision isotope shifts for the heavy elements. III. Singly ionized thorium (Th II).** Engleman R. Jr.; Palmer, B.A. (Chemistry Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of the Optical Society of America B: Optical Physics;* **1**: No. 6, 782-787(Dec 1984). Contract W-7405-ENG-36.

High-resolution Fourier-transform spectra of a $^{232}ThI_4$—$^{230}ThI_4$ electrodeless discharge lamp were obtained between 5600 and 36 000 cm^{-1}. These spectra were used to measure the splittings of more than 800 isotopic TH II doublets to an accuracy of about 0.001 cm^{-1}. From these isotope shifts, 184 even- and 167 odd-level isotope shifts were determined. Level isotope shifts were determined for all known levels below 20 000 cm^{-1}, except for the even J = 1/2 level at 19 594 cm^{-1}. An empirical correlation of the level isotope shifts with a theoretical, configuration-mixing calculation was used to derive pure-configuration level isotope shifts.

11794 **Photoelectron motion in the presence of a probe electromagnetic wave.** Ritchie, B. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Physical Review [Section] A: General Physics;* **30**: No. 5, 2323-2326(Nov 1984). Contract AC04-76DP00789.

Photoionization in the presence of a probe electromagnetic wave is studied. A continuum wave function is obtained in a weak-field, low-frequency limit for low-energy photoelectrons. When the electron and photon energies are comparable, the absorption and stimulated-emission angular distributions show a significant departure from results based on a much-used on-shell approximation of Kroll and Watson.

11795 **Noise in strong laser-atom interactions: Phase telegraph noise.** Eberly, J.H.; Wodkiewicz, K.; Shore, B.W. (Department of Physics and Astronomy, University of Rochester, Rochester, New York 14627). *Physical Review [Section] A: General Physics;* **30**: No. 5, 2381-2389(Nov 1984). Contract W-7405-ENG-48.

We discuss strong laser-atom interactions that are subjected to jump-type (random telegraph) random-phase noise. Physically, the jumps may arise from laser fluctuations, from collisions of various kinds, or from other external forces. Our discussion is carried out in two stages. First, direct and partially heuristic calculations determine the laser spectrum and also give a third-order differential equation for the average inversion of a two-level atom on resonance. At this stage a number of general features of the interaction are able to be studied easily. The optical analog of motional narrowing, for example, is clearly predicted. Second, we show that the theory of generalized Poisson processes allows laser-atom interactions in the presence of random telegraph noise of all kinds (not only phase noise) to be treated systematically, by means of a master equation first used in the context of quantum optics by Burshtein. We use the Burshtein equation to obtain an exact expression for the two-level atom's steady-state resonance fluorescence spectrum, when the exciting laser exhibits phase telegraph noise. Some comparisons are made with results obtained from other noise models. Detailed treatments of the effects ofmly jumps, or as a model of finite laser bandwidth effects, in which the laser frequency exhibits random jumps. We show that these two types of frequency noise can be distinguished in light-scattering spectra. We also discuss examples which demonstrate both temporal and spectral motional narrowing, nonexponential correlations, and non-Lorentzian spectra. Its exact solubility in finite terms makes the frequency-telegraph noise model an attractive alternative to the white-noise Ornstein-Uhlenbeck frequency noise model which has been previously applied to laser-atom interactions.

11796 **Static and dynamic shifts of spectral lines.** Boercker, D.B.; Iglesias, C.A. (Lawrence Livermore National Laboratory, University of California, Livermore, California 94550). *Physical Review [Section] A: General Physics;* **30**: No. 5, 2771-2774(Nov 1984). Contract W-7405-ENG-48.

The relationship between static and dynamic contributions to line shifts in hydrogen plasmas is investigated with use of a set of approximations common to line-shape theories. It is shown that when the coupling between states of different principal quantum

number is neglected, the asymmetry of the second-order width operator (due to detailed balance with the plasma) introduces a shift whose impact limit cancels approximately one-half of the second-order static shift. While the details of the calculation depend upon the approximations made, the primary conclusion that the second-order shift due to fluctuations can be as important as that due to static correlations does not. The possible implications of this result for plasmas with charged radiators are briefly discussed.

11797 **Application of R-matrix theory to resonant reactive electron-molecule scattering: Vibrational excitation and dissociative attachment of N_2 and F_2.** Wong, C.F.; Light, J.C. (The James Franck Institute and Department of Chemistry, The University of Chicago, Chicago, Illinois 60637). *Physical Review [Section] A: General Physics;* **30**: No. 5, 2264-2273(Nov 1984). Contract AC02-78ER04908.

Based on the R-matrix approach of Schneider et al. [J. Phys. B 12, L 365 (1979)] to reactive electron-molecule scattering, a new propagative R-matrix method (PRMM) is presented which is more appropriate for polyatomic systems. The new method should be useful in other calculations where complicated integrals need to be propagated. We also introduce an effective R-matrix model (ERMM) in which the usual resonance parameters (potential and width) can be used as input in model R-matrix calculations. The PRMM and ERMM have been applied to the electron-N_2 system and the electron-F_2 system. The results agree very well with previous calculations for both vibrationally inelastic scattering and dissociative attachment when identical potentials and parameters are used.

11798 **Noise in strong laser-atom interactions: Frequency fluctuations and nonexponential correlations.** Wodkiewicz, K.; Shore, B.W.; Eberly, J.H. (Department of Physics and Astronomy, University of Rochester, Rochester, New York 14627). *Physical Review [Section] A: General Physics;* **30**: No. 5, 2390-2398(Nov 1984). Contract AC02-78ER04908.

We extend our study of the effects of jump-type noise on laser-atom interactions to frequency-telegraph noise. Such noise can be used as a model of collisional effects, in which the atomic transition frequency randomly jumps, or as a model of finite laser bandwidth effects, in which the laser frequency exhibits random jumps. We show that these two types of frequency noise can be distinguished in light-scattering spectra. We also discuss examples which demonstrate both temporal and spectral motional narrowing, nonexponential correlations, and non-Lorentzian spectra. Its exact solubility in finite terms makes the frequency-telegraph noise model an attractive alternative to the white-noise Ornstein-Uhlenbeck frequency noise model which has been previously applied to laser-atom interactions.

11799 **Patterns of energy levels and spectra for polyatomic molecules.** Harter, W.G. (Theoretical Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Statistical Physics;* **36**: No. 3, 749-786(Sep 1984).

Quantum and semiclassical models for the dynamics of angular momentum are used to calculate the rotational and vibrational states of polyatomic molecules. SF_6 and C_6H_6 are considered in detail. (AIP)

11800 **Predictions of the bond length and vibrational frequency of Ge_2.** Northrup, J.E.; Cohen, M.L. (Lawrence Berkeley Lab., CA). *Chemical Physics Letters;* **102**: No. 5, 440-441(2 Dec 1983). Contract AC03-76SF00098.

A pseudopotential local spin density calculation of the bond length, vibrational frequency, and binding energy for the Σ/sub g/⁻ state of the germanium dimer is presented. Predictions for the equilibrium bond length and vibrational frequency are given. An overestimate of the binding energy is obtained; this is consistent with other local density calculations for sp bonded diatomic molecules.

11801 **Energy transfer studies between Ne and H_7O.** Coyle, D.E.; Bentley, J.; Winicur, D.H. (Univ. of Notre Dame, IN). *Chemical Physics Letters;* **97**: No. 4-5, 454-459(27 May 1983).

Translation to rotational energy transfer between metastably excited Ne and ground-state H_2O using crossed molecular beams is reported at five collision energies between 113 and 260 meV. The exchange is very efficient, and appears to proceed directly from translation to the rotational levels of the H_2O molecule rather than via a vibrationally perturbed complex as has been suggested for the Ar plus CO_2 system. 21 references, 5 figures, 1 table.

6404 Fluid Physics

REFER ALSO TO CITATION(S) 64041011510

11802 **(DOE/ER/13167—2) Geometric analysis of the solutions of two-phase flows: two-fluid model.** Kestin, J.; Zeng, D.L. (Brown Univ., Providence, RI (USA)). 1984. Contract AC02-84ER13167. 4p. NTIS, PC A02/MF A01 - GPO. File Number TI85004858.

Draft subject to revision.

This report contains a lightly edited draft of a study of the two-fluid model in two-phase flow. The motivation for the study stems from the authors' conviction that the construction of a computer code for any model should be preceded by a geometrical analysis of the pattern of trajectories in the phase space appropriate for the model. Such a study greatly facilitates the understanding of the phenomenon of choking and anticipates the computational difficulties which arise from the existence of singularities. The report contains a derivation of the six conservation equations of the model which includes a consideration of the simplifications imposed on a one-dimensional treatment by the presence of boundary layers at the wall and between the phases. The model is restricted to one-dimensional adiabatic flows of a single substance present in two phases, but thermodynamic equilibrium between the phases is not assumed. The role of closure conditions is defined but no specific closure conditions, or explicit equations of state, are introduced.

11803 **(DOE/NBM—5004071) Block-implicit multigrid solution of Navier-Stokes equations in primitive variables.** Vanka, S.P.; Leaf, G.K. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85004071.

We are interested in the development of an efficient general purpose calculation procedure for turbulent chemically reacting internal flows. Our approach is to solve the time averaged Navier-Stokes equations governing the conservation of mass, momentum, and chemical species and two turbulence quantities such as the kinetic energy of turbulence and its rate of dissipation. The equations in such a set are highly nonlinear and strongly coupled. Of particular mention is the coupling between the pressure and velocity fields implicitly through the momentum and continuity equations.

11804 **Structure factors for a binary mixture of quantum and classical fermion liquids.** Rasolt, M. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Physical Review [Section] B: Condensed Matter;* **31**: No. 3, 1615-1618(1 Feb 1985).

The structure factor of the electron liquid is examined in the presence of a classical liquid of nuclei. It is shown to acquire additional variation in the intermediate range of momentum transfer q. The relevance to x-ray scattering in liquid metals at small q is also discussed.

11805 **Intermittency and attractor size in isotropic turbulence.** Kraichnan, R.H. (303 Potrillo Drive, Los Alamos, New Mexico 87544). *Physics of Fluids;* **28**: No. 1, 10-11(Jan 1985). Contract W-7405-ENG-36.

Qualitative arguments suggest that the Kolmogorov 1941 (K41) inertial range for space dimensionality D3 corresponds to a maximum attractor size if compared with alternative inertial ranges in which intermittency increases as a power of wavenumber. Therefore upper bounds on attractor size consistent with K41 do not either rule out or imply intermittency corrections to the -5/3 law. In contrast, the K41 inertial range corresponds to minimum attractor size if $D>4$.

11806 **Solution of the Onsager equation in doubly connected regions.** (National Magnetic Fusion Energy Computer Center, Lawrence Livermore National Laboratory, Livermore, California 94550). *Journal of Computational Physics;* **56**: No. 3, 530-536(Dec 1984). Contract W-7405-ENG-48.

The pressure continuity requirement is applied in the context of the Onsager equation to solve for an unknown baffle stream function value.(AIP)

11807 **Application of photon correlation spectroscopy to flowing Brownian motion systems.** Chowdhury, D.P.; Sorensen, C.M.; Taylor, T.W.; Merklin, J.F.; Lester, T.W. (Kansas State University, Department of Nuclear Engineering & Physics, Manhattan, Kansas 66506). *Applied Optics;* **23**: No. 22, 4149-4154(15 Nov 1984). Contract AC02-80ER10677.

In this paper we study the application of photon correlation spectroscopy to a system of randomly diffusing particles suspended in a fluid undergoing uniform translational motion relative to the optical scattering volume. To do so we derive theoretical expressions for both the homodyne and heterodyne correlation functions in both the dilute and nondilute particle limits. We then test these results with experiments on a flowing system and find good agreement. We discuss a useful method of analysis and define limits to particle sizing in such a system using this light-scattering technique.

11808 **Model for the calculation of thermodynamic properties of a fluid: using hard-sphere perturbation theory and the zero-Kelvin isotherm of the solid.** Kerley, G.I. (Los Alamos National Lab., NM). *Advances in Chemistry Series;* No. 204, 107-138(1983).

The CRIS model of fluids is reviewed and calculations using the theory are compared with experimental data. The equation of state is computed from an expansion about a hard-sphere reference system, in which the optimum hard-sphere diameter is chosen by a variational principle. All information about the intermolecular forces is obtained from the zero-Kelvin isotherm of the solid. Calculations for the rare gases, for the hydrogen isotopes and other polyatomic molecules, and for liquid iron are shown to agree well with experiment. Liberman's model for the electronic structure of a compressed atom is used to calculate contributions from thermal electronic excitation to the equation of state. These terms are shown to be important in explaining shock-wave data for xenon.

6450 High Energy Physics

11809 **(DOE/ER—0210) Summaries of FY 1984 research in high energy physics.** (USDOE Office of Energy Research, Washington, DC. High Energy Physics Div.). Dec 1984. 309p. NTIS, PC A14/MF A01; GPO Dep. File Number DE85005641.

The US Department of Energy, through the Office of Energy Research, Division of High Energy and Nuclear Physics, provides approximately 90 percent of the total federal support for high energy physics research effort in the United States. The High Energy Physics Program primarily utilizes four major US high energy accelerator facilities and over 90 universities under contract to do experimental and theoretical investigations on the properties, structure, and transformation of matter and energy in their most basic forms. This compilation of research summaries is intended to present a convenient report of the scope and nature of high energy physics research presently funded by the US Department of Energy. The areas covered include: (1) conception, design, construction, and operation of particle accelerators; (2) experimental research using the accelerators and ancillary equipment; (3) theoretical research; and (4) research and development programs to advance accelerator technology, particle detector systems, and data analysis capabilities. Major concepts and experimental facts in high energy physics have recently been discovered which have the promise of unifying the fundamental forces and of unerstanding the basic nature of matter and energy.

11810 **(N—84-29694) Quarks.** Sammons, V.O. (Library of Congress, Washington, DC (USA)). Sep 1983. 9p. (TB—83-7). NTIS, PC A02/MF A01.

A guide to the available literature on quarks in the collections of the Library of Congress is provided. Some basic texts, state-of-the-art reviews and conferences, and journal articles are listed.

11811 **Particles and fields - 1983.** Abashian, A. (ed.). New York, NY; American Institute of Physics (1984). 307p. (CONF-8309196—). American Institute of Physics, 335 E. 45th Street, New York, NY 10017. File Number TI84008600.

From Meeting of the Division of Particles and Fields; Blacksburg, VA, USA (15 Sep 1983).

The meeting consisted of five plenary sessions of invited papers on the general topics of low energy and non-accelerator tests, particle discoveries and searches, quarks and gluons, theoretical speculations and assessments, and cosmology and particle physics. In addition, a special session of reports on future planning high energy physics and the role of the DPF in those efforts was held. Separate entries wre prepared for the data base for the 13 papers presented. (WHK)

11812 **Gauge theories, massive neutrinos, and proton decay.** Perlmutter, A. (ed.). New York, NY; Plenum Publishing Corp. (1981). 392p. (CONF-810134—). Plenum Publishing Corp., 233 Spring Street, New York, NY 10013. File Number TI85001578. Contract FG05-81ER40011.

From Orbis scientiae: gauge theories, massive neutrinos, and proton decay; Ft. Lauderdale, FL, USA (19 Jan 1981).

Maintaining the excellence of this series, this volume balances experimental and theoretical reviews of the latest developments in the field, illustrating points of interaction that will prove beneficial to both groups. Experimentalists represent critical developments in new accelerator plans, neutrino oscillations, proton decay, and decay schemes of the upsilon. The flurry of activity generated by recent evidence for massive neutrinos is amply reflected. A distinguished group of contributors addresses such topics as models of the universe; measuring the gluon density and the QCD running coupling constant; dual variables and conserved currents; gauge hierarchy, decoupling, and heavy particle effects; neutrino mixing in SO(10); results from beam dump experiments at CERN; and magnetic moments of composite fermions. Separate entries were made in the data base for the papers included. (WHK)

6451 Particle Interactions And Properties - Experimental

REFER ALSO TO CITATION(S) 64510011548, 11557, 11558, 11865, 11865, 11867, 11877

11813 **(ANL/HEP-CP—84-87) Physics at 10^{34} cm^{-2} s^{-1}.** Diebold, R.; Wagner, R. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 8p. (CONF-8406198—27). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004065.

From Design and utilization of the superconducting super collider summer study; Snowmass, CO, USA (23 Jun 1984).

Most of the detector studies at Snowmass-84 have rightfully concentrated on detailed studies of individual interactions - their rates, signatures, and backgrounds. Depending on the physics and the detector components, there seems to be agreement that general-purpose detectors will likely be able to accept luminosities up to 10^{32-33} cm^{-2} s^{-1}. The purpose of this paper is to show how the physics reach of the SSC is extended by going to a luminosity of 10^{34} cm^{-2} s^{-1}, to take a first look at what sort of detector could be used at this luminosity, and to discuss how one might trigger on interesting events in the presence of many overlapping minimum bias events. We will assume that the SSC turns on at 10^{31} or 10^{32} cm^{-2} s^{-1}, with an increase of luminosity to 10^{33} over a period of a few years as the machine and detectors become better understood. Thus, the lower mass scale will have been explored and we can set our thresholds high when running 10^{34}.

11814 (DESY—84-050) Measurements of energy correlations in e^+e^- -> hadrons. Bartel, W.; Becker, L.; Bowdery, C.; Cords, D.; Felst, R.; Haidt, D.; Knies, G.; Krehbiel, H.; Meinke, R.; Meissner, K. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Jun 1984. 28p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85750282.

Energy-energy-correlations (EEC) have been measured with the JADE detector at c.m. energies of 14 GeV, 22 GeV and in the region 29 GeV < Esub(cm) < 36 GeV. Corrected results are presented of EEC and their asymmetry, which can be directly compared to theoretical predictions. At < Esub(cm) > = 34 GeV a comparison with second order QCD predictions yields good agreement for the string model fragmentation resulting in a value of the strong coupling constant αsub(s) = 0.165 +- 0.01 (stat.) +- 0.01 (syst.). The independent fragmentation models, which yield values of αsub(s) between 0.10 and 0.15 depending on the treatment of energy and momentum conservation and of the gluon splitting, do not provide a satisfactory description of the data over the full angular range.

11815 (DESY—84-051) Search for heavy quarks in e^+e^- collisions up to 46.78 GeV C.M. energy. Behrend, H.J.; Buerger, J.; Criegee, L.; Fenner, H.; Franke, G.; Meyer, J.; Schroeder, V.; Sindt, H.; Timm, U.; Winter, G.G. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Jun 1984. 17p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85750280.

The total e^+e^- annihilation cross section into hadrons has been measured at c.m. energies between 33.00 and 36.72 GeV and between 38.66 and 46.78 GeV in steps of 20 and 30 MeV respectively. The average of the ratio R = sigma(e^+e^- -> hadrons)/ sigmasub(point) is <R> = 3.85 +- 0.12 and <R> = 4.04 +- 0.10 for the two energy ranges. The systematic error on <R> is 0.31. Both values are consistent with the expectation for the known coloured quarks u, d, s, c, and b. No evidence was found for the production of new quarks. If the largest fluctuation in R is interpreted as a narrow resonance, it corresponds to a product of the electronic width and the hadronic branching ratio GAMMAsub(ee) x Bsub(had) < 2.9 keV at the 95% confidence level, well below the value expected for the toponium vector ground state with charge 2/3 e. The observed number of aplanar final states rules out the continuum production of a new heavy flavour with pointlike cross section up to a c.m. energy of 45.4 GeV for a quark charge of 1/3 e and up to 46.6 GeV for 2/3 e at the 95% confidence level.

11816 (DESY—84-052) Evidence for Fsup(*) meson production in e^+e^- annihilation at 10 GeV center-of-mass energy. Albrecht, H.; Drews, G.; Harder, G.; Hasemann, H.; Philipp, A.; Schmidt-Parzefall, W.; Schroeder, H.; Schulz, H.D.; Selonke, F.; Wurth, R. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Jun 1984. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85750278.

Using the ARGUS detector at DORIS the authors have obtained evidence for a resonance which decays into an F meson and a photon. The observed mass is 2109 +- 9 +- 7 MeV, which is 144 +- 9 +- 7 MeV greater than the F meson mass. Its properties are consistent with those of the Fsup(*) meson with Jsup(P) = 1^-.

11817 (DESY—84-059) Charged Dsup(*) production in e^+e^- annihilation. Bartel, W.; Becker, L.; Bowdery, C.; Cords, D.; Felst, R.; Haidt, D.; Knies, G.; Krehbiel, H.; Meinke, R.; Naroska, B. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Jun 1984. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85750288.

The inclusive production of Dsup(*+-) mesons in e^+e^--annihilations at the proportional 34.4 GeV is investigated with the JADE detector at PETRA. Dsup(*+-) mesons are reconstructed through their decay into D mesons resulting in ($K\pi$)π and ($K3\pi$)π final states. The measured differential cross section is compatible with a hard c quark fragmentation. The Dsup(*+-) production angular distribution shows a charge asymmetry of A=-0.14+-0.09 which is in agreement with the expectation from the weak-electromagnetic interference effect in the standard model. Global properties of Dsup(*+-) events are seen to be similar to average multihadronic event properties.

11818 (DESY—84-061) Inclusive electron production from heavy quarks in e^+e^- annihilation at 34.6 GeV center of mass energy. Althoff, M.; Braunschweig, W.; Kirschfink, F.J.; Luebelsmeyer, K.; Martyn, H.U.; Rosskamp, P.; Sander, H.G.; Schmitz, D.; Siebke, H.; Wallraff, W. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Jul 1984. 19p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85750286.

The production of electrons by bottom and charm hadrons has been studied in e^+e^- annihilation at 34.6 GeV center of mass energy. It is observed that the b quark fragmentation function is peaked at large values of the scaling variable z with <zsub(b)> = 0.84 (+0.15+0.15-0.10-0.11). For c quarks <zsub(c)> = 0.57 (+0.10+0.05-0.09-0.06) is observed. A forward-backward charge asymmetry of A = -0.25 +- 0.22 was measured in b production.

11819 (DOE/ER/10699—T4) Preliminary results on neutrino proton elastic scattering. Marx, M.D. (State Univ. of New York, Stony Brook (USA)). Jun 1984. Contract AC02-80ER10699. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004841.

We present here, preliminary results on neutrino proton elastic scattering, measured by E 734, a Brookhaven-Brown-KEK-Osaka-Pennsylvania-Stony Brook-Tokyo collaboration, at the Brookhaven AGS.

11820 (DOE/ER/40025—17) Improved b lifetime measurement from MAC. Ford, W.T. (Colorado Univ., Boulder (USA). Dept. of Physics). Mar 1984. Contract AC02-81ER40025. 13p. (CONF-8403113—8). NTIS, PC A02/MF A01; GPO Dep. File Number DE85004840.

From Europhysics conference; Erice, Italy (4 Mar 1984).

Two recent publications, from the MAC and Mark II collaborations, have reported the somewhat surprising result that the lifetime of particles made up of b quarks is in the 1 to 2 picosecond range, or somewhat longer than the lifetimes of charm particles. Although the charm decays are favored transitions while those of b particles depend upon off-diagonal elements of the weak flavor mixing matrix, the smallness of the b decay rates in face of the large available phase space indicates that the off-diagonal elements are indeed very small. The possibility for complete determination of the mixing matrix was brought significantly nearer by the availability of the lifetime information; what is needed now is to reduce the uncertainty of the measurements, which was about 33% for both experiments. We describe here an extension of the b lifetime study with the MAC detector, incorporating some new data and improvements in the analysis. 12 references.

11821 (DOE/ER/40025—19) Recent results from PEP. Fernandez, E. (Colorado Univ., Boulder (USA). Dept. of Physics). 1984. Contract AC02-81ER40025. 83p. (CONF-8404215—2). NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85004866.

From 12. international winter meeting on fundamental physics; Santillana del Mar, Santa, Spain (9 Apr 1984).

Recent results from PEP are presented. These include measurements of branching fractions, fragmentation properties and lifetimes of heavy flavored particle, measurements of the electroweak asymmetries in quark pair and lepton pair production in e^+e^-, and results on new particle serrches. 62 references, 50 figures.

11822 (DOE/ER/40033—70) Experimental studies of elementary particle interactions at high energies. Technical progress report. Cool, R.L. (Rockefeller Univ., New York (USA)). 12 Nov 1984. Contract AC02-81ER40033. 22p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85004795.

The research progress at CERN is briefly described (experiments R-110 and UA-6). Research at FNAL is discussed involving the analysis of the inclusive photon dissociation experiment, E-612, and the design of a luminosity monitor and a recoil spectrometer to be installed inside the vacuum pipe of the collider. Also, research

on the Livermore Laboratory program (electron neutrino mass experiment) is discussed. Reports published are listed. (WHK)

11823 (IS-T—1145) Study of charm production in proton-proton interactions at $\sqrt{s}$ = 62 GeV with a forward K^- trigger. Gorbics, M.S. (Ames Lab., IA (USA)). Dec 1984. Contract W-7405-ENG-82. 67p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85005201.

The production of charm mesons D* and D and their subsequent decays $D^{*+} \rightarrow D^0\pi^+$ and $D^0 \rightarrow K^-\pi^+$ have been observed in proton-proton interactions at the CERN Intersecting Storage Rings. Using published data for inclusive K^- and anti p production cross sections as normalization, the D^{*+} production cross section is estimated. For a model with the D^{*+} produced with a Feynman-x (x/sub F/) distribution of the form (1-X/sub F/)^2 and a transverse momentum distribution of the form P/sub t/*exp(-P/sub t/^{2}), the D^{*+} production cross section is estimated to be 23.5 +- 8.4 μb. This measurement is approximately the same as measurements by other experiments of charm meson production at lower energies. Two other experiments have measured the D^0 production cross section at our energy, and obtained a result more than ten times higher than ours. Thus, our measurement provides a possible resolution to what had been an unclear situation in regard to the energy dependence of charm production.

11824 (KFK—3781) Investigation of the neutron-proton-interaction in the energy range from 20 to 50 MEV. Wilczynski, J. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik; Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Physik). Jul 1984. 95p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE85750295.

In the framework of the investigation of the isospin singlet part of the nucleon-nucleon-interaction in the energy range below 100 MeV two experiments were conducted, which were selected by sensitivity calculations. At the Karlsruhe polarized neutron facility POLKA the analyzing powers Asub(y) and Asub(yy) of the elastic n vector-p- and n vector-p vector-scattering were measured in the energy range from 20 to 50 MeV. The results of this experiment are compared to older data. In the energy range from 20 to 50 MeV the new data were analyzed together with other selected data of the nucleon-nucleon-system in phase shift analyses. The knowledge of the isospin singlet phase shifts $^1P_1$ and $^3D_3$ was improved by the new data.

11825 (N—84-30939) Weak corrections to the e+e-yields mu+mu- asymmetry. Brown, R.W.; Decker, R. (Dortmund Univ. (Germany, F.R.)). Jul 1983. 5p. (DO-TH—83-16). NTIS, PC A02/MF A01.

A study of the weak corrections to the e+e- yields mu+mu charge asymmetry reveals a sizable effect from the Z-boson self energy. All other weak corrections are negligible at present energies. A compact formula for the gamma Z box diagram is also presented.

11826 (N—84-30949) Activities in nuclear and high energy physics. (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands)). 1983. 133p. (In Dutch). (B—8467321). NTIS, PC A07/MF A01.

High energy and nuclear physics research concerning bubble chamber investigations, European hybrid system ACCMOR, WA 18, PETRA, PEP, VA 4, SING, LENA, LEP 3 and DELPHI experiments is summarized. Experiments with electron beams, and in pions and muons physics, and radiochemistry are reported on.

11827 Direct photon production in e^+e^- annihilation. Fernandez, E.; Ford, W.T.; Qi, N.; Read A.L. Jr.; Smith, J.G.; Camporesi, T.; De Sangro, R.; Marini, A.; Peruzzi, I.; Piccolo, M.; Ronga, F.; Blume, H.T.; Hurst, R.B.; Sleeman, J.C.; Venuti, J.P.; Wald, H.B.; Weinstein, R.; Band, H.R.; Gettner, M.W.; Goderre, G.P.; Meyer, O.A.; Moromisato, J.H.; Shambroom, W.D.; von Goeler, E.; Ash, W.W.; Chadwick, G.B.; Clearwater, S.H.; Coombes, R.W.; Kaye, H.S.; Lau, K.H.; Leedy, R.E.; Lynch, H.L.; Messner, R.L.; Moss, L.J.; Muller, F.; Nelson, H.N.; Ritson, D.M.; Rosenberg, L.J.; Wiser, D.E.; Zdarko, R.W.; Groom, D.E.; Lee, H.Y.; Delfino, M.C.; Heltsley, B.K.; Johnson, J.R.; Lavine, T.L.; Maruyama, T.; Prepost, R. (Department of Physics, University of Colorado, Boulder, Colorado 80309). *Physical Review Letters;* **54**: No. 2, 95-98(14 Jan 1985). Contract AC02-81ER40025;AC03-76SF00515;AC02-76ER00881.

Direct photon production in hadronic events from e^+e^- annihilation has been studied at $\sqrt{s}$ = 29 GeV with use of the MAC detector at the PEP storage ring. A charge asymmetry A = (-12.3 +- 3.5)% is observed in the final-state jets. The cross section and the charge asymmetry are in good agreement with the predictions of the fractionally charged quark-parton model. Both the charge asymmetry and total yield have been used to determine values of quark charges. Limits have been established for anomalous sources of direct photons.

11828 Experimental limits on the nucleon lifetime for two- and three-body decay modes. Park, H.S.; Blewitt, G.; Cortez, B.G.; Foster, G.W.; Gajewski, W.; Haines, T.J.; Kielczewska, D.; LoSecco, J.M.; Bionta, R.M.; Bratton, C.B.; Casper, D.; Chrysicopoulou, P.; Claus, R.; Errede, S.; Ganezer, K.S.; Goldhaber, M.; Jones, T.W.; Kropp, W.R.; Learned, J.G.; Lehmann, E.; Reines, F.; Schultz, J.; Seidel, S.; Shumard, E.; Sinclair, D.; Sobel, H.W.; Stone, J.L.; Sulak, L.R.; Svoboda, R.; van der Velde, J.C.; Wuest, C. (The University of California at Irvine, Irvine, California 92717; The University of Michigan, Ann Arbor, Michigan 48109; Brookhaven National Laboratory, Upton, New York 11973; California Institute of Technology, Pasadena, California 91125; Cleveland State University, Cleveland, Ohio 44115;). *Physical Review Letters;* **54**: No. 1, 22-25(7 Jan 1985).

Lower limits in the range of 10^{31} to 10^{32} yr for the partial lifetimes of a number of nucleon decay modes are obtained from a 204-live-day exposure in an 8-ktonne water Cherenkov detector (3.3 ktonne in the fiducial volume). During this period 169 contained events were observed at a rate and with characteristics consistent with expected backgrounds from atmospheric ν interactions. Nine of the contained events are compatible with either a ν interaction or nucleon decay into a number of non-ν modes.

11829 Measurements of spin-correlation parameters A/sub L/L and A/sub S/L for pp→πd between 500 and 800 MeV. Glass, G.; Bhatia, T.S.; Hiebert, J.C.; Kenefick, R.A.; Nath, S.; Northcliffe, L.C.; Tippens, W.B.; Barlow, D.B.; Saha, A.; Seth, K.K.; Boissevain, J.G.J.; Jarmer, J.J.; Simmons, J.E.; Jeppesen, R.H.; Tripard, G.E. (Texas A&M University, College Station, Texas 77843). *Physical Review [Section] C: Nuclear Physics;* **31**: No. 1, 288-291(Jan 1985).

Measurements of A/sub L/L between 500 and 800 MeV and spin dependent cross sections derived from these measurements are presented for the reaction pp→πd at c.m. angles θ/sub π/(of 50°, 70°, and 90°. Angular distributions for A/sub S/L are also presented for energies 500, 650, and 800 MeV. These are the first measurements of spin-correlation parameters in this channel above 590 MeV, and are in substantial disagreement with theoretical predictions of the triplet amplitudes above 600 MeV.

11830 **Evidence for the F/sup / meson.** Aihara, H.; Alston-Garnjost, M.; Badtke, D.H.; Bakken, J.A.; Barbaro-Galtieri, A.; Barnes, A.V.; Barnett, B.A.; Blumenfeld, B.J.; Bross, A.D.; Buchanan, C.D.; Chamberlain, O.; Chiba, J.; Chien, C.; Clark, A.R.; Cordier, A.; Dahl, O.I.; Day, C.T.; Derby, K.A.; Eberhard, P.H.; Enomoto, R.; Fancher, D.L.; Fujii, H.; Fujii, T.; Gabioud, B.; Gary, J.W.; Gorn, W.; Hadley, N.J.; Hauptman, J.M.; Hofmann, W.; Huth, J.E.; Hylen, J.; Iwasaki, H.; Kamae, T.; Kaye, H.S.; Kenney, R.W.; Kerth, L.T.; Koda, R.I.; Kofler, R.R.; Kwong, K.K.; Layter, J.G.; Lindsey, C.S.; Loken, S.C.; Lu, X.; Lynch, G.R.; Madansky, L.; Madaras, R.J.; Majka, R.M.; Martin, P.S.; Maruyama, K.; Marx, J.N.; Matthews, J.A.J.; Melnikoff, S.O.; Moses, W.; Nemethy, P.; Nygren, D.R.; Oddone, P.J.; Park, D.A.; Pevsner, A.; Pripstein, M.; Robrish, P.R.; Ronan, M.T.; Ross, R.R.; Rouse, F.R.; Sauerwein, R.R.; Shapiro, G.; Shapiro, M.D.; Shen, B.C.; Slater, W.E.; Stevenson, M.L.; Stork, D.H.; Ticho, H.K.; Toge, N.; van Daalen Wetters, R.F.; VanDalen, G.J.; van Tyen, R.; Wang, E.M.; Wayne, M.R.; Wenzel, W.A.; Yamamoto, H.; Yamauchi, M.; Zeller, M.E.; Zhang, W. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720; University of California, Los Angeles, California 90024; University of California, Riverside, California 92521; Johns Hopkins University, Baltimore, Maryland 21218; University of Massachusetts, Amherst,). *Physical Review Letters;* 53: No. 26, 2465-2468(24 Dec 1984).

Evidence for a narrow state decaying into an F meson and a photon has been obtained in e^+e^- annihilation events at 29 GeV c.m. energy. This state lies 139.5 +- 8.3(stat) +- 9.7(syst) MeV above the F-meson mass and is consistent with the expected F(meson. The F mesons are identified by a peak in the $K^+K^-\pi^{+-}$ mass at 1.948 +- 0.028 +- 0.010 GeV.

11831 **Primakoff production of the $B^+(1235)$ meson.** Collick, B.; Heppelmann, S.; Joyce, T.; Makdisi, Y.; Marshak, M.L.; Peterson, E.A.; Ruddick, K.; Berg, D.; Chandlee, C.; Cihangir, S.; Ferbel, T.; Huston, J.; Jensen, T.; Lobkowicz, F.; Ohshima, T.; Slattery, P.; Thompson, P.; Zielinski, M.; Jonckheere, A.; Nelson C.A. Jr. (University of Minnesota, Minneapolis, Minnesota 55455). *Physical Review Letters;* 53: No. 25, 2374-2377(17 Dec 1984).

We have measured the coherent nuclear production of $\pi^+\omega$ systems at 202.5 GeV. This final state is dominated by the $B^+(1235)$ meson with a measured mass and full width of 1.271 +- 0.011 GeV and 0.232 +- 0.029 GeV, respectively. A radiative width of 230 +- 60 keV was extracted for the process $B^+(1235) \rightarrow \pi^+\gamma$. .AE

6452 Particle Interactions And Properties - Theoretical

REFER ALSO TO CITATION(S) 64520011851, 11857, 11863, 11867, 11888

11832 **(ANL-HEP-CP—83-45) Monoponucleosis: the wonderful things that monopoles can do to nuclei if they are there.** Lipkin, H.J. (Argonne National Lab., IL (USA); Weizmann Inst. of Science, Rehovoth (Israel); Fermi National Accelerator Lab., Batavia, IL (USA)). 1983. Contract W-31-109-ENG-38. 17p. (CONF-8310227—9). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005030.

From Monopole '83 conference; Ann Arbor, MI, USA (6 Oct 1983).

In this talk we consider the wonderful things that monopoles can do to nuclei by examining nuclear physics in strong magnetic fields. We have seen that monopoles can bind nuclei. We shall investigate the following other possible processes: (1) mixing of singlet and triplet states of deuteron-like positronium; (2) production of a new kind of nuclear matter with nucleon moments oriented in the field; (3) catalysis of nuclear fission; (4) catalysis of nuclear fusion (with implications for solar neutrinos); and (5) enhancement of forbidden decays like triplet positronium, e.g. fission products.

11833 **(ANL-HEP-CP—84-76) Report of the Snowmass hadronization group.** Derrick, M.; Gottschalk, T. (Argonne National Lab., IL (USA); California Inst. of Tech., Pasadena (USA)). 1984. Contract W-31-109-ENG-38. 28p. (CALT—68-1197; CONF-8406198—32). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85004818.

From Design and utilization of the superconducting super collider summer study; Snowmass, CO, USA (23 Jun 1984).

Most of the data on jets and the relationship to the parent partons has come from e^+e^- annihilation which provides a particularly simple laboratory. A number of Monte Carlo (MC) models have been developed that are quite successful in describing the overall character e^+e^- events. Although such comparisons provide an essential foundation, hadronic interactions are much more complicated and the detailed modeling of these processes is at a more primitive level of development. In this report, we review in detail the state-of-the-art of this modeling, including some comparisons with data. We highlight the experiments that are needed in order to guide the future developments of the models and give a detailed discussion of the relevant theoretical issues. Finally, we consider what can be measured at the SSC itself and make some suggestions for further work in this area. 128 references, 50 figures.

11834 **(CONF-8304153—2) Diffraction: what do we know; what can we learn.** Randa, J. (Colorado Univ., Boulder (USA). Dept. of Physics). May 1983. Contract AC02-81ER40025. 23p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004870.

From 11. international winter meeting on fundamental physics; Toledo, Spain (11 Apr 1983).

High energy diffractive scattering is reviewed. We first summarize experimental results and information gleaned from geometric and optical models. We then discuss dynamics from the perspectives of hadron structure and Pomeron structure. Particular emphasis is placed on investigating hadron structure using a simple model of the Pomeron. 58 references.

11835 **(DESY—84-053) Monte Carlo calculation of hadron masses with light dynamical quarks.** Langguth, W.; Montvay, I. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Jun 1984. 18p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85750281.

Gound state meson and baryon masses are numerically calculated in lattice QCD with unquenched Wilson-fermions on an 8^4 lattice.

11836 **(DESY—84-055) Massive Yang-Mills - an effective Lagrangian for composite Wsup(+-), Z and new coloured vector bosons.** Schrempp, B.; Schrempp, F. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). May 1984. 37p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85750284.

The framework is weak interactions, interpreted as residual (hypercolor) interactions among composite q,l,Wsup(+-) and Z. An effective Lagrangian Lsub(eff) for "low energies" (E < or approx. Gsub(F)sup(-1/2)) is derived from 1) a specification of the global chiral symmetry G of weak interactions (for α,αsub(color)->0), 2) local U(1)sub(em)xSU(3)sub(c) gauge invariance and 3) vector boson dominance in the operator form of current-field identities. The result is a massive Yang-Mills Lagrangian with respect to the global group G. Lsub(eff) for q,l,W,Z interactions, basing on G = SU(2)sub(WI) of global weak isospin, turns out to be identical (in its dimension <= 4 operator part) to the Lagrangian of the standard (GSW) model in the unitary gauge without the physical Higgs. Lsub(eff) predictions are argued to closely mimic the GSW predictions due to the chiral nature of G and the smallness of the effective coupling constant. An extension of the scheme to larger symmetry groups as expected from preon models for α,αsub(color)->0 (e.g. G = SU(2)sub(WI)xSU(4)sub(Pati-Salam)) is proposed. This implies the existence of new colored (and uncolored) composite vector bosons and vector dominance in the gluon sector. Lsub(eff) then determines the interactions of these new bosons with quarks and leptons in terms of a few free parameters. Interesting consequences for panti p collider and HERA experiments as well as for precision experiments at low energies emerge.

11837 **(DESY—84-056) Comparison of quark and gluon jets.** Schierholz, G. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Jun 1984. 19p. (CONF-8403130—6). NTIS (US Sales Only), PC A02/MF A01. File Number DE85750285.

From 4. topical workshop on proton antiproton collider physics; Bern, Switzerland (5 Mar 1984).

If QCD is the underlying theory of the strong interactions, quark and gluon jets should appear to be rather different in nature. Discussed is the (theoretical) roots of this difference and to what extent it has been borne out experimentally.

11838 **(DOE/ER/40008—68) Research in theoretical elementary particle physics. Annual progress report.** Field, R.D.; Ramond, P.M.; Thorn, C.B. (Florida Univ., Gainesville (USA)). 1 Nov 1984. Contract AS05-81ER40008. 22p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85004859.

This is a progress report on the fourth year of operation of the Theoretical Particle Physics group at the University of Florida. The group has been very productive over the last year publishing numerous research papers covering a broad range of topics in theoretical high energy physics. In addition, members of our group have traveled and given important talks at national and international physics conferences. The research we have accomplished in such subjects as quantum field theory, quantum chromodynamics, grand unified theories, and high energy phenomenology has increased mankind's understanding of elementary particle physics. Research activities are summarized, and publications are listed. (WHK)

11839 **(DOE/ER/40033—55) Technical progress report, November 1, 1983-October 31, 1984.** Beg, M.A.B.; Khuri, N.N.; Pais, A. (Rockefeller Univ., New York (USA). Dept. of Physics). 1984. Contract AC02-81ER40033. 20p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85004842.

Progress on theoretical high-energy physics and field theory is briefly described. Research topics include consistency of the canonically-realized Salam-Weinberg theory, supergravity Kaluza-Klein theory, a simple supergravity GUT, a mechanism for fermion mass generation was considered and applied to the lepton sector of the Weinberg-Salam model, an N=1 locally supersymmetric theory, a local topological charge density for 2d U(1) lattice gauge fields, the 2d O(3) σ-model, Minkowski space-time, quantum field theory, non-Abelian gauge theories and algebraic topology, the semiclassical approximation in quantum field theory, the origin of the CP violation, and others. Publications are listed. (WHK)

11840 **(FNAL/C—84/87-T) Probing for preon structure via gluons.** Albright, C.H.; Bars, I. (Northern Illinois Univ., Dekalb (USA); Fermi National Accelerator Lab., Batavia, IL (USA); University of Southern California, Los Angeles (USA)). Sep 1984. Contract AC02-76CH03000. 4p. (CONF-8406198—36). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005510.

From Design and utilization of the superconducting super collider summer study; Snowmass, CO, USA (23 Jun 1984).

Gluons form an important fraction of the partons at small x in anti pp scattering at SSC energies (approx. 40 TeV). Therefore, gluon reactions at the SCC may be expected to yield important signals for compositeness, if the preon scale is a few TeV. Here we develop a quantitative method for estimating many gluon scattering processes. Some of our estimates are model independent. We also propose explicit formulas for various scattering amplitudes based on a Veneziano-type beta function model that exhibits resonances and Regge behavior. Many interesting spectacular signatures are suggested in the resonance region, where massive vector bosons and/or excited and exotic quarks and leptons can be produced.

11841 **(FNAL/C—84/99-T) Some comments on α/sub s/ and Λ/sub anti MS/.** Durand, B. (Wisconsin Univ., Madison (USA). Dept. of Physics). Sep 1984. Contract AC02-76CH03000. 4p. (CONF-8406198—34). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85003780.

From Design and utilization of the superconducting super collider summer study; Snowmass, CO, USA (23 Jun 1984).

Some new determinations of the strong coupling constant α/sub s/ from hadronic and leptonic decay widths of quarkonia are added to the accumulation of data on α/sub s/ as a function of Q. When compared with the renormalization group prediction of $1/\alpha$/sub s/ vs ln Q, parameterized by the QCD scale parameter Λ/sub anti MS/, these new points do very little to resolve whether α/sub s/ runs as predicted, and if so, on which Λ/sub anti MS/ curve. 6 references.

11842 **(LBL—18701) Resonances in photon-photon scattering.** Chanowitz, M.S. (Lawrence Berkeley Lab., CA (USA)). Nov 1984. Contract AC03-76SF00098. 28p. (CONF-8409194—1). NTIS, PC A03/MF A01; GPO Dep. File Number DE85004607.

From 6. international workshop on photon-photon collisions; Lake Tahoe, CA, USA (9 Sep 1984).

A quantity called stickiness is introduced which should be largest for J not equal to 0 glueballs and can be measured in two photon scattering and radiative J/psi decay. An argument is reviewed suggesting that light J = 0 glueballs may have large couplings to two photons. The analysis of radiative decays of eta and eta' is reviewed and a plea made to desist from false claims that they are related to $\Gamma(\pi^0 \to \gamma\gamma)$ by SU(3) symmetry. It is shown that two photon studies can refute the difficult-to-refute hypothesis that ξ(2220) or zeta(8320) are Higgs bosons. A gallery of rogue resonances and resonance candidates is presented which would usefully be studied in $\gamma\gamma$ scattering, including especially the low mass dipion. 34 references.

11843 **(N—84-30937) Staggered fermions and rotation-gauge invariance.** Parisi, G.; Yi-Cheng, Z. (Rome Univ. (Italy)). Jul 1983. 20p. NTIS, PC A02/MF A01.

The rotational invariance of the staggered fermions on the lattice are studied, by considering them as spin zero fields in a quenched gauge field background. The noninteger spin fermionic fields are reconstructed. Bilinear operators (i.e., meson fields) in terms of the quark fields on a cube are classified according to the representations of the discrete rotational group. (ESA)

11844 **(N—84-30938) Some negative results for avoiding lattice fermionic doubling.** Parisi, G.; Yi-Cheng, Z. (Rome Univ. (Italy)). Jul 1983. 7p. NTIS, PC A02/MF A01.

It is shown that it is impossible to solve the lattice fermion doubling problem via random fields in the perturbative framework. (ESA)

11845 **Comparison of the canonical Hamiltonian and the Hamiltonian of Callan and Rubakov for the monopole-fermion system.** Sen, A. (Fermi National Accelerator Laboratory, P.O. Box 500, Batavia, Illinois 60510). *Physical Review [Section] D: Particles and Fields;* **31**: No. 2, 433-434(15 Jan 1985).

We compare the canonical Hamiltonian of the monopole-fermion system, derived by Goldstein and Yamagishi, with the Hamiltonian derived by Callan in the bosonized formulation.

11846 **Derivation of the Wolfenstein form of the Kobayashi-Maskawa matrix from fermion masses.** Rosen, S.P. (Theoretical Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review [Section] D: Particles and Fields;* **31**: No. 1, 208-210(1 Jan 1985).

An empirical, perturbative approach to the fermion mass matrix is used to examine the derivation of the Wolfenstein form of the Kobayashi-Maskawa matrix as a power series in the Cabibbo-angle parameter $\lambda = \sin\theta$/sub C/. With the aid of an SU(3) family symmetry, the theory is extended to neutrinos and predictions are made about their Dirac masses and mixing angles.

11847 **Second-order corrections to the muon anomalous magnetic moment in alternative electroweak models.** Moore, S.R.; Whisnant, K.; Young, B. (Department of Physics and Ames Laboratory, Iowa State University, Ames, Iowa 50011). *Physical Review [Section] D: Particles and Fields;* **31**: No. 1, 105-117(1 Jan 1985).

We study the second-order weak correction to the muon anomalous magnetic moment in alternative electroweak gauge theories. The gauge-boson contributions are constrained by low-energy weak-interaction phenomenology. We examine the Higgs-boson

contributions in three classes of models and find that they are potentially the dominant effect. Contributions of lepton-number-violating Higgs-boson interactions are calculated and included in the analysis. Severe limits on the spontaneous-symmetry-breaking scales and Yukawa couplings are found in some scenarios which have a separate scale for fermion masses, including the standard model with more than one doublet and a left-right model which naturally explains small neutrino masses. Higgs-boson effects may be detectable when order-of-magnitude improvements are made in the measurement of the muon anomalous magnetic moment.

11848 **Dissipative phenomena in quark-gluon plasmas.** Danielewicz, P.; Gyulassy, M. (Nuclear Science Division, Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Physical Review [Section] D: Particles and Fields;* **31**: No. 1, 53-62(1 Jan 1985).

Transport coefficients of small-chemical-potential quark-gluon plasmas are estimated and dissipative corrections to the scaling hydrodynamic equations for ultrarelativistic nuclear collisions are studied. The absence of heat-conduction phenomena is clarified. Lower and upper bounds on the shear-viscosity coefficient are derived. QCD phenomenology is used to estimate effects of color-electric and -magnetic shielding, and nonperturbative antiscreening. Bulk viscosity associated with the plasma-to-hadron transition is estimated within the relaxation-time approximation. Finally, effects of dissipative phenomena on the relation between initial energy density and final rapidity density are estimated.

11849 **Constraints on radiative Z_0 decays.** Drell, S.D.; Parke, S.J. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305). *Physical Review Letters;* **53**: No. 21, 1993-1995(19 Nov 1984). Contract AC03-76SF00515.

We study an effective local interaction as a possible source of hard photons in the decay $Z_0 \rightarrow$ll-bary. We restrict the form of this interaction by the requirements that it be SU(2) x U(1) gauge invariant, CP invariant, and chirality conserving. Including constraints derived from the agreement of the standard model in other neutral current experiments, we find that the ratio of radiative to nonradiative leptonic decay widths is given by 0.6(M/sub Z/ /M/ sub Λ/)^4 where M/sub Λ/ is the mass scale characterizing the "new physics." This ratio is less than the preliminary experimental indication of approximately 10% if M/sub Λ/ is greater than 150 GeV.

6453 Particle Invariance Principles And Symmetries

REFER ALSO TO CITATION(S) 64530011856

11850 **(BONN-HE—84-15) Quantum mechanics with extended supersymmetry and nonabelian gauge constraints.** Flume, R. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). Jul 1984. 48p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85750294.

A weakly restricted general class of quantum mechanical models with at least four real supercharges and nonabelian gauge constraints are analyzed. The innocently looking restrictions lead automatically and exclusively to the quantum mechanics which are the dimensionally reduced counterparts of supersymmetric Yang-Mills field theories. This result provides in turn an independent proof that N=1, N=2 and N=4 Yang-Mills fields are the only possible supersymmetric gauge field theories (without central charges) in four dimensions.

11851 **(DOE/ER/40025—31) Lattice Monte Carlo calculations of finite temperature QCD.** DeGrand, T. (Colorado Univ., Boulder (USA)). 1984. Contract AC02-81ER40025. 23p. (CONF-8406189—9). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004035.

From 4. international conference on ultrarelativistic nucleus-nucleus collisions - QUARK MATTER '84; Helsinki, Finland (17 Jun 1984).

The author discusses fairly generally the current status of the lattice description of the deconfinement transition and the properties of hadronic matter at high (and low) temperature T. An ultimate goal of these investigations is to learn whether or not QCD actually predicts the naive phase diagram. A more realistic goal, which is at present partially within our grasp, is to compute the static properties of QCD matter at T > 0 from first principles. These include the order of phase transitions, critical temperatures T/sub c/, critical exponents or latent heat, but not dynamical critical properties, such as the behavior of Green's functions near T/sub c/. The author knows of no first- principles discussions of non-equilibrium properties of QCD, which would be required for a description of the experiments. In fact, experimentalists should think of the world studied by lattice or Monte Carlo methods as a little crystal in an oven whose temperature is kept constant in time. The author begins by giving a short description of how we set up the finite-temperature field theory on a lattice to display the important parts of the calculation without going too much into details. Then the author discusses recent progress in our understanding of the glue world - pure gauge theories - and ends by discussing the physically relevant case of fermions and gauge fields.

6454 Field Theory

REFER ALSO TO CITATION(S) 64540011738, 11812, 11838, 11839, 11845, 11848, 12019

11852 **(BONN-HE—84-9) Stochastic variables in N=1 supersymmetric Yang-Mills theory.** Lechtenfeld, O. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). Jun 1984. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85750274.

The stochastic structure of N=1 supersymmetric Yang-Mills theory is rederived by using a previously developed method for the construction of the (nonlocal) Nicolai map. The stochastic variables correspond to the fixed points of this mapping. The relations are derived in a light cone gauge and in general covariant gauges.

11853 **(FNAL/C—84/88-T) Standard model and beyond.** Quigg, C. (Fermi National Accelerator Lab., Batavia, IL (USA)). Sep 1984. Contract AC02-76CH03000. 19p. (CONF-840873—4). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004269.

From US summer school on high energy particle accelerator; Batavia, IL, USA (13 Aug 1984).

The SU(3)/sub c/ circle crossSU(2)/sub L/circle crossU(1)/sub Y/ gauge theory of ineractions among quarks and leptons is briefly described, and some recent notable successes of the theory are mentioned. Some shortcomings in our ability to apply the theory are noted, and the incompleteness of the standard model is exhibited. Experimental hints that Nature may be richer in structure than the minimal theory are discussed. 23 references.

11854 **(N—84-30940) Flavor mixing and the six quark model.** Jarlskog, C. (Stockholm Univ. (Sweden)). May 1984. 13p. (USIP—84-08). NTIS, PC A02/MF A01.

The status of quark mixing is reviewed. The determination of the parameters of the Kobayashi-Maskawa matrix and the Wolfenstein matrix are discussed. The observed family-mixing pattern is extrapolated to a hypothetical fourth family. The most optimistic possibility for having long-lived very heavy flavor is discussed.

11855 **Gauge invariance and the finite-element solution of the Schwinger model.** Bender, C.M.; Milton, K.A.; Sharp, D.H. (Department of Physics, Washington University, St. Louis, Missouri 63130). *Physical Review [Section] D: Particles and Fields;* **31**: No. 2, 383-388(15 Jan 1985).

We apply the method of finite elements to two-dimensional quantum electrodynamics. We construct gauge-invariant operator difference equations and compute the chiral anomaly in the Schwinger model. The relative error between the exact answer and the finite-element prediction vanishes like M^{-3}, where M is the number of finite elements.

11856 QCD chiral-symmetry breaking in a Rayleigh-Ritz variational calculation. Castorina, P.; Pi, S. (Center for Theoretical Physics, Laboratory for Nuclear Science and Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Physical Review [Section] D: Particles and Fields;* **31**: No. 2, 411-415(15 Jan 1985).

Within a Rayleigh-Ritz variational calculation for QCD, we establish the occurrence of chiral-symmetry breaking if the force is sufficiently strong. The logarithmic behavior of gauge coupling is essential for the result.

11857 Reducing the number of flavors in the microcanonical method. Martin, O.; Otto, S.W. (Columbia University, New York, New York 10027). *Physical Review [Section] D: Particles and Fields;* **31**: No. 2, 435-437(15 Jan 1985).

A recently suggested thinning scheme for including dynamical fermions into microcanonical lattice QCD calculations is discussed. It is proved that for any lattice volume and lattice spacing, the method is exact.

11858 Where is the continuum in lattice quantum chromodynamics?. Kennedy, A.D.; Kuti, J.; Meyer, S.; Pendleton, B.J. (Institute for Theoretical Physics, University of California, Santa Barbara, California 93106). *Physical Review Letters;* **54**: No. 2, 87-91(14 Jan 1985).

We present a Monte Carlo calculation of the quark-liberating phase transition in lattice quantum chromodynamics. The transition temperature as a function of the lattice coupling g does not scale according to the perturbative beta function for $6/g^2 < 6.1$. We use finite-size scaling in analyzing the properties of the lattice system near the transition point.

11859 Bound and radiation fields of a pointlike SO(3) monopole. Sorg, M. (Institut fuer Theoretische Physik, Universitaet Stuttgart, Pfaffenwaldring 57, D-7000 Stuttgart 80, West Germany). *Journal of Mathematical Physics (New York);* **26**: No. 1, 89-98(Jan 1985).

The macroscopic field of a pointlike, arbitrarily moving monopole is split up into its bound and radiation parts. The SO(2) fiber bundle, having the total monopole field as its curvature, is embedded into an SO(3) bundle (Georgi—Glashow model) such that the SO(2) monopole field is composed in an SO(3) invariant manner by the microscopic gauge and Higgs fields: The Higgs field constitutes the bound part and the gauge field (Yang—Mills field) is responsible for the radiation part of the macroscopic monopole field. The role played by the field equations for the validity of separate local energy-momentum conservation laws is discussed extensively.

11860 Symmetries of gauge fields. Molelekoa, M. (National University of Lesotho, P. O. Roma 180, Lesotho, Africa). *Journal of Mathematical Physics (New York);* **26**: No. 1, 192-197(Jan 1985).

The concept of homogeneity for a gauge field is introduced as an appropriate geometrical interpretation of the symmetric properties of the gauge field relative to a group of space-time transformations. It is more general than the formulation in terms of an invariant connection, as illustrated by an example on translational symmetries. Sufficient conditions are given for invariance to be equivalent to homogeneity. Both finite and infinitesimal symmetries are treated.

6455 Scattering Theory

11861 Electromagnetic inverse problem for dispersive media. Beezley, R.S.; Krueger, R.J. (Department of Mathematics, University of Nebraska, Lincoln, Nebraska 68588). *Journal of Mathematical Physics (New York);* **26**: No. 2, 317-325(Feb 1985). Contract W-7405-ENG-82.

The dispersion of transient electromagnetic waves in a homogeneous medium can be characterized by expressing either the complex permittivity as a function of frequency or the susceptibility kernel as a function of time. In this paper, a time domain technique is used to derive a nonlinear integrodifferential equation which relates the susceptibility kernel for a one-dimensional homogeneous slab to the reflection operator for the medium. Thus, the susceptibility kernel (which is a function of time) can be determined from reflection data. A numerical implementation of this technique is shown. The more general case of a medium consisting of a stack of homogeneous dispersive layers is also addressed.

65 PHYSICS. II.

6510 Nuclear Physics

REFER ALSO TO CITATION(S) 65100011832

11862 (CONF-8411118—8) Simultaneous evaluation of interrelated cross sections by generalized least-squares and related data file requirements. Poenitz, W.P. (Argonne National Lab., Idaho Falls, ID (USA)). 25 Oct 1984. Contract W-31-109-ENG-38. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005019.

From Meeting on nuclear standard reference data; Geel, Belgium (12 Nov 1984).

Though several cross sections have been designated as standards, they are not basic units and are interrelated by ratio measurements. Moreover, as such interactions as $^6Li + n$ and $^{10}B + n$ involve only two and three cross sections respectively, total cross section data become useful for the evaluation process. The problem can be resolved by a simultaneous evaluation of the available absolute and shape data for cross sections, ratios, sums, and average cross sections by generalized least-squares. A data file is required for such evaluation which contains the originally measured quantities and their uncertainty components. Establishing such a file is a substantial task because data were frequently reported as absolute cross sections where ratios were measured without sufficient information on which reference cross section and which normalization were utilized. Reporting of uncertainties is often missing or incomplete. The requirements for data reporting will be discussed.

11863 (DOE/HIR—85/1) Heavy-Ion Reactions: a current awareness bulletin. Kinser, W.H. (ed.). (USDOE Office of Scientific and Technical Information, Oak Ridge, TN). Jan 1985. 12p. (PB—85-900501). NTIS, PC A02/MF A01; GPO Dep. File Number DE85003160.

Available on a subscription basis at $14.00 per volume (calendar) year.

This current awareness bulletin announces on a semimonthly basis the current worldwide information entered into the Energy Data Base on theoretical and experimental studies (including instrumentation) of heavy-ion ($A > 4$) nuclear reactions for nuclear structure studies; for producing new isotopes and superheavy elements for nuclear, atomic, and chemical properties studies; for understanding quantum chromodynamics as an exact theory of the strong nuclear force; and for studying the equations of state and phases of nuclear matter (pion condensate and quark matter) of special interest in astrophysics, and cosmology. An abstract is included with each citation. Regular publication began in January 1985. (WHK)

6511 Experimental Techniques

11864 Application of alpha spectrometry to the discovery of new elements by heavy-ion beam bombardment. Nitschke, J.M. (Lawrence Berkeley Lab., CA (USA). Nuclear Science Div.). *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors, and Associated Equipment;* **223**: No. 2/3, 303-311(15 Jun 1984). (CONF-830539—). Contract AC03-76SF00098.

From International meeting for radionuclide metrology - alpha particle spectrometry and low level measurement; Harwell, UK (10 May 1983).

Starting with polonium in 1898, alpha spectrometry has played a decisive role in the discovery of new, heavy elements. For even-even nuclei, alpha spectra have proven simple to interpret and exhibit systematic trends that allow extrapolation to unknown isotopes. The early discovery of the "natural" alpha decay series led to the very powerful method of "genetically" linking the decay of new elements to the well-established alpha emission of "daughter"

and "granddaughter" nuclei. This technique has been used for all recent discoveries of new elements, including Z = 109. Up to mendelevium (Z = 101), thin samples suitable for alpha spectrometry were prepared by chemical methods. With the advent of heavy-ion accelerators, new sample preparation methods emerged. These were based on the large momentum transfer associated with heavy-ion reactions, which produced energetic target recoils that, when ejected from the target, could be thermalized in helium gas. Subsequent electrical deposition or a helium jet technique yielded samples that were not only thin enough for alpha spectrometry, but also for alpha and beta-recoil experiments. Many variations of these methods have been developed and will be covered in this paper. For the synthesis of element 106, an aerosol-based recoil transport technique was devised. In this most recent experiments, alpha spectrometry has been coupled with the magnetic analysis of the recoils. The time from production to analysis of an isotope has thereby been reduced to 10^{-6} s, while it was 10^{-1}-10^{0} s for helium jets and 10^{1}-10^{3} s for rapid chemical separations. Experiments are now in progress to synthesize super heavy elements (SHE) and to analyse them with these latest techniques. Again, alpha spectrometry will play a major role, since the expected signature for the decay of a SHE is a sequence of alpha decays followed by spontaneous fission. 35 refs.

6512 Nuclear Properties And Reactions, A=1-5

REFER ALSO TO CITATION(S) 65121011867

11865 (ANL-HEP-CP—84-82) Nucleon-nucleon interaction at medium energies. Spinka, H. (Argonne National Lab., IL (USA)). 1984. Contract W-31-109-ENG-38. 23p. (CONF-8410202—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005028.

From IUCF workshop on nuclear physics with stored cooled beams; Spencer, IN, USA (14 Oct 1984).

A summary of the medium energy nucleon-nucleon elastic and inelastic scattering data is presented from an experimenter's viewpoint. Motivation for additional measurements is given. Experiments which rely on the unique capabilities of the Indiana Cooler are emphasized. 65 references.

11866 (DOE/ER/10407—5) Theoretical nuclear reaction and structure studies using kaons and photons. Progress report. Cotanch, S.R. (North Carolina State Univ., Raleigh (USA). Dept. of Physics). 1984. Contract AS05-79ER10407. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85006482.

Progress is reported on studies of kaon electroproduction from the proton and deuteron and shell model studies of photonuclear reactions. Publications are listed. (WHK)

11867 (TRI-PP—84-100) Bremsstrahlung and radiative processes at medium energies. Fearing, H.W. (British Columbia Univ., Vancouver (Canada). TRIUMF Facility). Oct 1984. 10p. (CONF-8410202—2). NTIS (US Sales Only), PC A02/MF A01. File Number DE85900432.

From IUCF workshop on nuclear physics with stored cooled beams; Spencer, IN, USA (14 Oct 1984).

Some general features of the electromagnetic interaction are discussed, features which make it useful as a probe of nuclear and few body systems. Then some specific reactions are reviewed, including pp → ppγ, np → npγ, pd → ^{3}Heγ, dd → ^{4}Heγ, and A(p,γ)A+1, with the aim of focusing on some of the interesting physics which perhaps could be investigated via such reactions at a medium energy proton facility with stored cooled beam as is being developed at IUCF. 64 references.

6513 Nuclear Properties And Reactions, A=6-19

11868 (CONF-841117—41) Nuclear physics experiments with the ORNL-HHIRF supersonic gas jet target. Shapira, D.; Gomez del Campo, J.; Ford, J.L.C. Jr.; Shivakumar, B.; Stelson, P.H.; Harmon, B.A.; Parks, R.A.; Thornton, S.T. (Oak Ridge National Lab., TN (USA); Virginia Univ., Charlottesville (USA). Dept. of Physics). 1984. Contract AC05-84OR21400. 17p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005260.

From 8. conference on the application of accelerators in research and industry; Denton, TX, USA (12 Nov 1984).

A study of target-like fragments produced by bombarding a ^{14}N target with 150 MeV ^{28}Si shows that mass and charge distribution of products from orbiting processes is determined by partitioning of an equilibrated dinuclear system. The experiment was performed with the HHIRF supersonic gas jet target which is also described briefly. 6 references, 10 figures.

11869 (INIS-mf—8887) Nuclear reaction n + ^{3}He -> ^{1}H + ^{3}H as proximity reaction. Hilber, H.C. (Bochum Univ. (Germany, F.R.). Abt. fuer Physik und Astronomie). 9 Jul 1982. 177p. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE85780103.

The present thesis tries to give by means of the nuclear reaction n + ^{3}He -> ^{1}H + ^{3}H as proximity reaction on the three-particle system ^{3}He + ^{9}Be -> ^{1}H + ^{3}H + ^{8}Be an experimental verification to the second term of a multiple scattering series. The study of these rescattering effects is of great interest for the present theory of the final-state interaction. At three incident energies (7.08 MeV, 8.98 MeV, and 6.37 MeV) to detector telescopes identify the exit channel of the three-particle system in list-mode coincidence experiments according to protons and tritons. Peaks on the kinematical curves occur. The detailed study of their kinematic behaviour allows to exclude the inconcurrence to the proximity reaction lying cascade decays via intermediate states in ^{4}He, ^{9}B, and ^{11}B. Regarding the Coulomb interaction the experimental results can be also explained in the sense of the classical kinematics by the proximity model.

11870 Inclusive pion production in 330, 400, and 500 MeV proton-nucleus collisions. DiGiacomo, N.J.; Clover, M.R.; DeVries, R.M.; Dousse, J.C.; Kapustinsky, J.S.; McGaughey, P.L.; Sondheim, W.E.; Sunier, J.W.; Buenerd, M.; Lebrun, D. (Physics Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review [Section] C: Nuclear Physics;* **31**: No. 1, 292-294(Jan 1985).

We present measurements of the inclusive π^{+-} momentum distributions and total pion production cross sections for 330, 400, and 500 MeV protons incident on ^{12}C and ^{238}U. The π^{+}/π^{-} cross section ratio is seen to increase sharply with decreasing projectile energy for the light nucleus. Comparisons are also presented of the projectile energy systematics of data and intranuclear cascade calculations in the intermediate energy region.

6514 Nuclear Properties And Reactions, A=20-38

11871 (LBL—18712) Looking for anomalons with a segmented Cerenkov detector. Olson, D.L. (Lawrence Berkeley Lab., CA (USA)). Oct 1984. Contract AC03-76SF00098. 16p. (CONF-8410210—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004608.

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

An experiment performed at the Lawrence Berkeley Laboratory Bevalac, Expt. 676H, to study the anomalon effect with a segmented total-internal-reflection Cerenkov detector is reported. Radiators of 3mm thick BK7W optical glass and 2mm thick fused silica and a beam of ^{40}Ca at 2.1 GeV/nucleon were used. Results are presented and discussed.

6515 Nuclear Properties And Reactions, A=39-58

11872 Resonance neutron capture by ^{39,41}K. Macklin, R.L. (Oak Ridge National Laboratory, Oak Ridge, TN). *Nuclear Science and Engineering;* **88**: No. 2, 129-142(Oct 1984).

Neutron capture by a sample enriched in ^{41}K and by a natural potassium sample (93.26% ^{39}K) was measured at the Oak Ridge Electron Linear Accelerator as a function of neutron time of flight over a 40-m flight path. Resonance peaks were fitted by a least-squares fitting program to obtain Breit-Wigner resonance parameters. The energy range extended to all resonances below 153 keV. Corresponding average capture at a temperature typical of stars, kT = 30 keV, is calculated as (11.8 + or - 0.4) mb for ^{39}K and (22.0 + or - 0.7) mb for ^{41}K.

6516 Nuclear Properties And Reactions, A=59-89

11873 (LBL—18726) Unusual behavior of projectile fragments formed in the bombardment of copper with relativistic Ar ions. Dersch, G.; Beckmann, R.; Feige, G.; Lund, T.; Vater, P.; Brandt, R.; Aleklett, K.; Friedlander, E.M.; Loveland, W.; Herrmann, J. (Lawrence Berkeley Lab., CA (USA); Marburg Univ. (Germany, F.R.). Kernchemie und Fachbereich Physik; Studsvik Science Research Lab., Nykoeping (Sweden); Oregon State Univ., Corvallis (USA). Dept. of Chemistry; Purdue Univ., Lafayette, IN (USA). Dept. of Chemistry). Nov 1984. Contract AT06-78ER70035;AC03-76SF00098. 19p. (CONF-8410210—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005482.

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

The interaction properties of projectile fragments from the fragmentation of 0.9 A GeV and 1.8 A GeV ^{40}Ar with Cu have been studied using radioactivation techniques. Projectile fragments formed in the interaction of the primary Ar beam with a thick Cu disk (the target disk) interacted with a second detector Cu disk. The relative reaction product yields in the two disks were measured as a function of the separation between the disks. A large increase in the yield of deep spallation products (^{24}Na, ^{28}Mg) in the detector disk was observed as the projectile energy increased from 0.9 A GeV to 1.8 A GeV. At 1.8 A GeV (but not at 0.9 A GeV) the yields of the deep spallation products decreased as the separation between the disks increased indicating either a dramatic broadening of the relevant projectile fragment angular distribution between 0.9 A GeV and 1.8 A GeV or a decay in flight of some of the projectile fragments at 1.8 A GeV (but not at 0.9 A GeV). Calculations will be discussed that cast doubt on the first possibility. 15 references.

11874 Precompound limits of linear momentum transfer in heavy ion reactions. Blann, M. (Lawrence Livermore National Laboratory, Livermore, California 94550). *Physical Review* [*Section*] *C: Nuclear Physics;* **31**: No. 1, 295-297(Jan 1985).

The Boltzmann master equation is used to predict linear momentum transfer for reactions of ^{60}Ni with ^{16}O at lab energies of 8.8 to 100 MeV/nucleon. Results are in excellent agreement with experimental measurements at ^{16}O energies up to 19.6 MeV/nucleon.

6517 Nuclear Properties And Reactions, A=90-149

11875 (DOE/ER/04699—8) Experiments on the TASS and HISS spectrometers at the Bevalac. Annual progress report, April 1, 1984-March 31, 1985. Kirk, P.N. (Louisiana State Univ., Baton Rouge (USA). Intermediate Energy Nuclear Physics Group). Dec 1984. Contract AS05-76ER04699. 57p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85004877.

Research at the Two Armed Spectrometer System and the Heavy Ion Spectrometer System at the Bevalac by the Louisiana State University group is briefly described. Topics include forward-backward correlation measurements in proton-carbon collisions at 2.1 GeV, search for anomalons, subthreshold negative pions and energetic protons produced at wide angles in 246 MeV per nucleon ^{139}La + ^{139}La collisions, rapidity distributions of pions produced in Ca + Ca interactions at 1.05 GeV per nucleon, and the ratio of leptons to pions produced in the interactions between protons and Be. Radiation detector development is discussed. Two attached papers include the multinomial distribution and the calculation of particle multiplicities in segmented detectors and blackbody radiation from thermal fireballs. (WHK)

11876 (GSI—84-6) Reaction mechanisms in the collision of ^{92}Mo on ^{92}Mo at an incident energy of 14.7 MeV/Nucleon. Gralla, S. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); Heidelberg Univ. (Germany, F.R.)). Jun 1984. 102p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE85750292.

For the study of the reaction mechanisms between heavy ions at high incident energies the reaction ^{92}Mo+^{92}Mo was studied at 14.7 MeV/u. From the one-particle inclusive data resulted that the energy loss mechanism at small energy losses can be explained by stochastic particle-hole transitions. Generally the reaction proceeds still widely binary over the whole range of the energy loss. The 3-body events amount at large energy losses up to 10% of the 2-body events, but generally they contribute only by about 3% to the whole reaction cross sections. The breakup into three heavy fragments seems to proceed timely sequentially. The variance of the break up mass distribution is so large that nuclei down to carbon are formed with considerable cross sections. These products are clearly visible in the one-particle inclusive element distribution. But very large and very low masses are also observed in the binary exit channels if at complete damping mass distribution with half-widths are reached which correspond to the mass of the projectile/target. Furthermore it could be shown that the collision partners in peripheral collisions seem to behave transparently. The dissipation of the radial energy begins gradually, but then increases quickly in a small angular momentum range.

11877 (LBL—18708) Space station as quark matter factory. Gyulassy, M. (Lawrence Berkeley Lab., CA (USA)). Nov 1984. Contract AC03-76SF00098. 11p. (CONF-8410206—1). NTIS, PC A02. File Number DE85004606.

From Workshop on cosmic ray and high energy gamma ray experiments for the space station ERA; Baton Rouge, LA, USA (17 Oct 1984).

We review the theoretical arguments indicating that hadronic matter dissolves into a quark gluon plasma at energy densities only one order of magnitude above the energy density in nuclei and point out that such energy densities can be achieved in nuclear collisions at 10 to 1000 AGeV. 17 references.

11878 Pion inelastic scattering to giant resonances and low-lying collective states in ^{118}Sn and ^{40}Ca. Ullmann, J.L.; Kraushaar, J.J.; Masterson, T.G.; Peterson, R.J.; Raymond, R.S.; Ristinen, R.A.; King, N.S.P.; Boudrie, R.L.; Morris, C.L.; Anderson, R.E.; Siciliano, E.R. (University of Colorado, Boulder, Colorado 80309). *Physical Review* [*Section*] *C: Nuclear Physics;* **31**: No. 1, 177-189(Jan 1985).

A comparison of differential cross sections for inelastic scattering of 130 MeV positive and negative pions has been made for studying the giant resonance region in ^{118}Sn and ^{40}Ca. In addition, several of the low-lying collective states in each target were examined. Comparison to distorted wave impulse approximation calculations allowed collective deformation lengths βR and fractions of the energy-weighted sum rules to be extracted. For bound collective states, the strengths for π^+ and π^- were nearly equal, as has been found for other scattering probes. Giant quadrupole and dipole excitations in ^{40}Ca (T = 0) had nearly equal π^+ and π^- sum rule strengths. Quadrupole and monopole excitations in ^{118}Sn near 14 MeV show about twice the π^- transition strengths compared to those for π^+, contrary to expectations from simple isoscalar models.

6518 Nuclear Properties And Reactions, A=150-189

REFER ALSO TO CITATION(S) 6518101891

11879 (LA-UR—84-3812) Low-lying isovector excitations in heavy nuclei. Ginocchio, J.N. (Los Alamos National Lab., NM (USA)). 31 Oct 1984. Contract W-7405-ENG-36. 15p. (CONF-8410144—4). NTIS, PC A02/MF A01; GPO Dep. File Number DE85005727.

From International symposium on nuclear shell model; Philadelphia, PA, USA (31 Oct 1984).

The neutron-neutron and proton-proton effective interaction in nuclei is qualitatively different than the neutron-proton effective interaction in nuclei. This difference can lead to low-lying isovector J/sup $\pi/=2^+$ states in heavy nuclei. 19 references.

11880 Nuclear data sheets for A = 161. Helmer, R.G. (Idaho National Engineering Laboratory, EC&G Idaho, Inc., Idaho Falls, Idaho 83415, USA). *Nuclear Data Sheets;* **43**: No. 1, 1-125(Sep 1984).

The experimental results from the various reaction and decay studies leading to nuclides in the A = 161 mass chain, and α decays from it, have been reviewed. These data are summarized and presented, together with adopted level schemes and properties.

6520 Nuclear Properties And Reactions, A=220 And Above

11881 (BNL-NCS—35522) Least squares fit of thermal data for fissile nuclei. Divadeenam, M.; Stehn, J.R. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 9p. (CONF-8411118—5). NTIS, PC A02/MF A01; GPO Dep. File Number DE85004712.

From Meeting on nuclear standard reference data; Geel, Belgium (12 Nov 1984).

Since our previous paper was written, we have learned of one new set of measurements that would have been included had we known of it: Gwin, Spencer and Ingle's measurement of the nu-prompt ratios of the four fissile materials with respect to ^{252}Cf. Their recently published paper reports revised final results for ^{233}U, ^{235}U and ^{239}Pu and includes a measurement on anti nu/sub p/(241)/anti nu/sub p/(252) that was not attempted previously. In some of the fitted results reported here, we have replaced their earlier 1978/1981 values by the final 1984 set. The replacement has appreciable effect on some of the parameters. Another revised value that we have used here is Axton's 1984 revision (3.7509 +- 0.0107) of his 1982 ^{252}Cf anti nu/sub p/ value (3.744 +- 0.021). The effect of including the revised result is not appreciable. Thermal constants for ^{233}U, ^{235}U, ^{239}Pu, and ^{241}Pu are given. 11 references. (WHK)

11882 (CONF-8411118—10) Final results of the internal ^{235}U sample intercomparison and the half-life of ^{234}U. Poenitz, W.P.; Meadows, J.W. (Argonne National Lab., Idaho Falls, ID (USA)). 1984. Contract W-31-109-ENG-38. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005049.

From Meeting on nuclear standard reference data; Geel, Belgium (12 Nov 1984).

Finalized values were recieved from all laboratories which contributed samples to the ^{235}U mass intercomparison carried out at Argonne National Laboratory. A least-squares fit was made which included the quoted masses and the absolute low-geometry and relative 2π-geometry alpha data as well as the relative fission ratios measured at ANL. Correlations between the measured values were taken into account. The values quoted by the contributing laboratories were found to be within +-0.35% of the values obtained from the LS fit. Very precise values for the isotopic composition were known for two of the sample materials which permitted a determination of the half-life of ^{234}U. The value obtained is T/sub 1/2/ = (2.457 +- 0.005) x 10^5 years. Including this value in the present data base results in a current best value of T/sub 1/2/ = (2.4566 +- 0.0044) x 10^5 years. 6 references, 2 figures, 6 tables.

11883 (EGG-M—24584) Report on the participation of US laboratories in the work of the IAEA coordinated research program on the measurement and evaluation of transactinium isotope nuclear decay data. Reich, C.W. (EG and G Idaho, Inc., Idaho Falls (USA)). 1984. Contract AC07-76ID01570. 4p. (CONF-841106—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85004317.

From Inter-regional seminar on practical problems encountered in the safe transport of radioactive materials; Vienna, Austria (5 Nov 1984).

In this report, we summarize the current status of the work being carried out in various US laboratories that is specifically oriented toward the objectives of this IAEA CRP. Reported below are the gamma-ray emission probability measurements, and related work, at INEL and α-particle related work being conducted by I. Ahmad at ANL. The results of the work of the US Half-Life Evaluation Committee on the half-lives of ^{234} ^{240} ^{241}Pu have now all been published; and no additional information regarding this activity is included in this report.

11884 (GSI—84-47(Prepr.)) Discovery of element 108 - the island of α-active nuclei beyond element 105. Armbruster, P. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Jul 1984. 37p. (CONF-8406212—1). NTIS (US Sales Only), PC A03/MF A01. File Number DE85750269.

From International school of physics "Enrico Fermi"; Varenna, Italy (18 Jun 1984).

The discovery of element ^{265}108 is described together with the new isotopes $^{259-261}$106. The decay properties of the isotopes are given. The production cross sections are presented. The mass excess of ^{260}106 is determined and it is shown that the isotopes of elements Z > 106 have shell stabilisations of more than -5 MeV. The high shell stabilisation is reflected in high fission barriers and surprisingly high lifetimes of the even-even isotopes against spontaneous fission of about 10 ms. High α-energies for the proton rich isotopes and decreasing α-decay lifetimes allow α-decay to compete with spontaneous fission. The α-active island of light isotopes for elements beyond 106 is discussed. An extrapolation to heavier element shows that superheavy elements around ^{277}114 should decay by α-emission and could be unabmiguously detected by their daughters which are the isotopes discovered. The limitations of fusion are discussed. The dynamical hindrances in the entrance channel reduces the cross sections of evaporation residues dramatically beyond a certain value of the ratio between Coulomb and nuclear forces. The thermal hindrance in the exit channel prevents the compound system to survive, as the shell stabilisation is lost already at moderate excitation energies. It is shown that especially the spherical nuclei only profit from their shell stabilisation at excitation energies below 20 MeV. The prospects to go beyond element 109 are discussed.

11885 Coincidence electron scattering (e,e'f) and multipole strength functions in ^{238}U. Griffioen, K.A.; Countryman, P.J.; Knoepfle, K.T.; Van Bibber, K.; Yearian, M.R.; Woodworth, J.G.; Rowley, D.; Calarco, J.R. (Department of Physics and High Energy Physics Laboratory, Stanford University, Stanford, California 94305). *Physical Review Letters;* **53**: No. 25, 2382-2385(17 Dec 1984). Contract W-7405-ENG-48.

We report ^{238}U(e,e'f) spectra from fission threshold to 23-MeV excitation energy for three values of momentum transfer (q = 0.26, 0.40, and 0.55 fm^{-1}). The extracted strength functions for E1 and E2/E0 agree well with those recently calculated with the quasiparticle random-phase approximation, except that some E2 strength is apparently missing. E3 and/or higher multipoles clearly contribute a significant amount of cross section throughout the excitation region.

11886 Reaching the capacity of a composite nucleus for energy and spin containment. Jacquet, D.; Duek, E.; Alexander, J.M.; Borderie, B.; Galin, J.; Gardes, D.; Guerreau, D.; Lefort, M.; Monnet, F.; Rivet, M.F.; Tarrago, X. (Institut de Physique Nucleaire, F-91406 Orsay Cedex, France). *Physical Review Letters;* **53**: No. 23, 2226-2229(3 Dec 1984).

The reaction 1080-MeV $^{40}Ar + ^{238}U$ has been studied via correlated fission fragments and He particles. Between (1/3) and (1/2) of the reaction cross section goes into fusionlike events to form composite nuclei excited to 500—800 MeV. The probability for such high-energy containment drops dramatically for ^{40}Ar projectiles between 27 and 44 MeV/u. Evaporative He particles for fusionlike events (multiplicity ~1.5) have been found to arise predominantly from the massively excited composite nuclei.

6530 Nuclear Theory

11887 (DOE/ER/40145—1) Progress in research, November 1, 1983-October 31, 1984. Tamura, T. (Texas Univ., Austin (USA). Dept. of Physics). Nov 1984. Contract FG05-84ER40145. 55p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85005609.

Progress is described on the following studies: reactions induced by light ions (MSDR analysis of continuum spectra, breakup-fusion description of continuum spectra of particles from light-ion induced reactions, and assessment of approximations made in breakup-fusion descriptions); reactions induced by heavy ions (direct reaction description of complete fusion, knockout processes in (^{6}Li, ^{6}Li') reactions, and DWBA analysis of resonance structure in the $^{16}O(^{16}O, ^{12}C)^{20}Ne(4^+)$ reaction); and boson expansion theories and collective nuclei. (WHK)

11888 (DOE/ER/40154—1) Research in theoretical nuclear physics. Progress report, February 1, 1984-October 31, 1984. Liu, K.F. (Kentucky Univ., Lexington (USA)). 1984. Contract FG05-84ER40154. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85006172.

Progress is briefly described. The meson-nucleon scattering phase shifts are calculated for the Skyrme soliton with spin and isospin projections. The mixing of the S/sub 1/2/^{6} and S/sub 1/2/^{4} P/sub 3/2/^{2} configurations in the MIT bag model is calculated and it shows a large effect. The production of Q^2 anti Q^2 mesoniums which decay to vector meson pairs are studied in $\gamma\gamma$ reactions, hadronic collisions and J/psi radiative decays. A possible measurement of the quark gluon plasma temperature in relativistic heavy ion collisions is proposed. The vacuum to glueball transition amplitudes are measured in a lattice gauge Monte Carlo calculation. Fusion reactions of the polarized deuterons are calculated in DWBA formalism. An extended Skyrme-Landau effective NN interaction is being developed so that nuclear structure calculations can be carried out. Publications are listed.

11889 (FNAL/C—84/93-T) Probes of the quark-gluon plasma as it might be produced in ultra-relativistic nuclear collisions. McLerran, L. (Fermi National Accelerator Lab., Batavia, IL (USA)). 1984. Contract AC02-76CH03000. 3p. (CONF-840757—27). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005500.

From 22. international conference on high energy physics; Leipzig, German D.R. (19 Jul 1984).

The energy densities which might be achieved in ultra-relativistic nuclear collisions are discussed. Using these estimates, promising probes of a quark-gluon plasma as it might be produced in such collisions are reviewed. I discuss in detail the emission of photons and di-leptons. The consequences of hydrodynamic expansion and a first order phase transition are explored for the transverse momentum spectrum of hadrons. Fluctuations in the rapidity distribution of hadrons are also discussed as a possible signal for a first order phase transition. The possibility that copious production of strange particles may signal the production of a quark-gluon plasma is also critically assessed. 24 references.

11890 (GSI—84-44(Prepr.)) Mean-field dynamics versus two-body collisions at intermediate energy heavy-ion reactions. Cassing, W. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Jul 1984. 38p. (CONF-8406207—2). NTIS (US Sales Only), PC A03/MF A01. File Number DE85750270.

From Workshop on coincident particle emission from continuum states (OPECOS '84); Bad Honnef, F.R. Germany (4 Jun 1984).

Nucleus-nucleus collisions in the energy range from 10 MeV/u to 150 MeV/u are investigated in the framework of the Wigner transformed von-Neumann equation on the level of the one-body density matrix. Two-body collisions permitted by the Pauli principle are included via a collision term of the Uehling-Uhlenbeck type. The time evolution of the phase-space density is studied in detail for central collisions of $^{40}Ca + ^{40}Ca$ within a time-dependent finite two-center shell model. Special emphasis is ascribed to high momentum components in beam direction which are generated by the time-dependent mean field. These high momentum components, essentially decaying by two-body collisions, are energetic enough to allow for pion production already at 20 MeV/u laboratory bombarding energies in case of heavy nuclei. The competition between one-body and two-body effects is investigated with respect to decay times for primary distorted momentum distributions. Linear momentum transfer by one-body (wall) and two-body collisions turns out to be strongly correlated with nonequilibrium light particle emission in terms of Fermi-jets as well as scattered energetic nucleons. Double differential preequilibrium neutron spectra $d^2N/dTHETAdE$ in coincidence with central collisions of $^{40}Ca + ^{40}Ca$ at 20 MeV/u are calculated for primary and secondary emission processes.

11891 (GSI—84-45(Prepr.)) Quantum interference and statistical fluctuations in deep inelastic heavy-ion reactions. Spangenberger, H.; Beck, F.; Feldmeier, H. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Jul 1984. 45p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85750272.

Starting from the general multi-channel formulation of the scattering matrix the authors perform the coarse-grain average of the cross section appropriate for the observed quantities in heavy-ion reactions. The authors keep full track of the geometrical factors for the coupling of partial waves and channel spin. Relating the diagonal part of the S-matrix product semiclassically to the statistical treatment in terms of phase space trajectories they are dealing with quantum fluctuations and statistical fluctuations on an even basis. Quantum corrections play a minor role if the underlying statistical model takes effects of the nonthermalized relative motion properly into account. This is true even for small energy losses.

11892 (GSI—84-46(Prepr.)) Dissipation and fluctuation of the relative momentum in nucleus-nucleus collisions. Feldmeier, H.; Spangenberger, H. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Jul 1984. 54p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85750273.

The dissipation of the relative momentum in nucleus-nucleus collisions is treated in terms of a Langevin equation with a fluctuating force. Equations of motion for first and second moments of the macroscopic variables are derived directly from the Langevin equation. The properties of the fluctuating force which results from random particle exchange are investigated in detail. Drift and diffusion coefficients are calculated microscopically and analytical expressions are given which can be used in any trajectory calculation. An important feature of the model is that the Einstein relation between dissipation and fluctuation turns out to be only a limiting case of a more general expression which included nonthermal fluctuations. By treating the two nuclei as intrinsically equilibrated but not in thermal equilibrium with respect to each other several important aspects of the dissipative behaviour, seen in heavy ion collisions with final energies above the Coloumb barrier, can be understood.

11893 (LBL—18697) Phase transitions in nuclear matter. Glendenning, N.K. (Lawrence Berkeley Lab., CA (USA)). Nov 1984. Contract AC03-76SF00098. 22p. (CONF-8410210—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004611.

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

The rather general circumstances under which a phase transition in hadronic matter at finite temperature to an abnormal phase in which baryon effective masses become small and in which copious baryon-antibaryon pairs appear is emphasized. A preview is also given of a soliton model of dense matter, in which at a density

of about seven times nuclear density, matter ceases to be a color insulator and becomes increasingly color conducting. 22 references.

11894 **Dynamical basis generation method with an application to the four-nucleon problem.** Bozzolo, G.; Vary, J.P.; Plastino, A. (Physics Department, Iowa State University, Ames, Iowa 50011). *Physical Review [Section] C: Nuclear Physics;* **31**: No. 1, 207-211(Jan 1985). Contract AC02-82ER40068.

A variational method inspired by the Hartree-Fock approximation but not restricted to a single Slater determinant trial space is investigated. The physical motivation is that a method should attempt to find a subspace of collective states which are most strongly coupled to the ground state. This method attempts to do this by providing a systematic technique to generate basis states from the collective Hartree-Fock type of state. In the resulting basis space a residual diagonalization is easily performed. Results of a test with the four-nucleon problem with realistic effective nuclear Hamiltonians are shown.

11895 **Nuclear dynamical supersymmetry.** Casten, R.F.; Da Hsuan Feng. (Neutron Nuclear Physics, Brookhaven National Laboratory). *Physics Today;* **37**: No. 11, 26-35(Nov 1984). Contract AC02-76CH00016.

Until recently, supersymmetry existed only as a theoretical concept; recent studies of atomic nuclei hint that it may be a physical reality.

6540 Radiation And Shielding Physics

REFER ALSO TO CITATION(S) 65400011389

11896 **(AD-A—143225/1) Time development of Cherenkov Radiation. Technical report.** Buskirk, F.R.; Neighbours, J.R. (Naval Postgraduate School, Monterey, CA (USA)). May 1984. 28p. (NPS—61-84-006). NTIS, PC A03/MF A01.

Most developments of Cherenkov Radiation are in terms of the Fourier components of the fields and power emitted by a single electron. When many electrons in a compact bunch are emitted from an accelerator, the bunch radiates coherently and at a lower frequency than for a single electron. The theory for the time structure of the fields arising from a charge bunch is developed, and it is shown that the source of the radiation is di/dt. Present detector technology should be able to resolve these fields.

11897 **(AD-A—143350/7) Radiation from intense electron beams associated with the Cherenkov mechanism. Technical report.** Neighbours, J.R.; Buskirk, F.R. (Naval Postgraduate School, Monterey, CA (USA)). 1 Jun 1984. 26p. (NPS—61-84-010). NTIS, PC A03/MF A01.

This report summarizes the Cherenkov radiation to be expected from an intense electron beam for both the coherent and incoherent modes of radiation. The effects of a finite length beam are discussed with regard to beam diffraction, radiated power, and bunch shape. The appendices contain a discussion of the beam radiation pattern.

11898 **(GSF-S—957) Measurement of the radial density distribution of the light emissions near the trajectory of fast ions in nitrogen.** Ibach, T. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Strahlenschutz). Nov 1983. 106p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE85750268.

For the analysis of the emission and deceleration mechanisms of ionisation-electrons (delta-electrons) during the passage of fast ions through gases, the radial density distribution of the light emission has been measured, which is related with the (0,0)-transitions of two optical bands in nitrogen. These measurements have been made using a small aperture limited ion beam. The first band under study is the 2. positive system at 337.1 nm excited mainly by low energy electrons around 20 eV, and the second band is the 1. negative system at 391.4 nm excited by fast electrons with simultaneous ionisation. For these measurements an experimental setup has been developed with a telescope-like optical system and interference filters to detect the emitted light with a high spacial resolution ($4x10^{-4}$ of profile width) and a high dynamic range (10^6). The experiments have been performed using proton beams of different energies between 270 keV and 2.8 MeV, He-3 beams with 270 keV/u and 500 keV/u and a Ne beam with 270 keV/u with gas pressures in the range between 0.133 to 13.3 mbar. Based on the method of Abel inversion the spacial light emission density is deduced from the experimental distance functions and normalized to a gas density of 1 g/cm^3. The results show that approximately half of the total light emission in the 1. negative system and the ionisation is caused by the primary interaction of the ion beam. For the same energy per nucleon this contribution decreases relative to the contribution of the delta-electrons with increasing atomic number. In addition the delta-radiation becomes harder with increasing atomic number. Good agreement is obtained by comparison with the results of other authors, which are based on probe techniques and Monte-Carlo calculations.

11899 **(LA—10049-M-Rev.1) User's guide for TWODANT: a code package for two-dimensional, diffusion-accelerated, neutral-particle transport. Revision 1.** Alcouffe, R.E.; Brinkley, F.W.; Marr, D.R.; O'Dell, R.D. (Los Alamos National Lab., NM (USA)). Oct 1984. Contract W-7405-ENG-36. 43p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85005335.

TWODANT solves the two-dimensional multigroup transport equation in x-y, r-z, and r-theta geometries. Both regular and adjoint, inhomogeneous (fixed source and homogeneous (k-effective and eigenvalue search)) problems subject to vacuum, reflective, periodic, white, or inhomogeneous boundary flux conditions are solved. General anisotropic scattering is allowed and anisotropic inhomogeneous sources are permitted. TWODANT numerically solves the two-dimensional multigroup form of the neutral-particle, steady-state Boltzmann transport equation. The discrete-ordinates form of approximation is used for treating the angular variation of the particle distribution and the diamond-difference scheme is used for space-angle discretization. Negative fluxes are eliminated by a local set-to-zero-and-correct algorithm. A standard inner (within-group) iteration, outer (energy-group-dependent source) iteration technique is used. Both inner and outer iterations are accelerated using the diffusion synthetic acceleration method. The diffusion solver uses the multigrid method and Chebychev acceleration of the fission source.

11900 **(PNL-SA—11484) Mean delta-ray energies in ion-molecule collisions.** Wilson, W.E. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1983. Contract AC06-76RL01830. 13p. NTIS, PC A02. File Number DE85005524.

A simple analytic expression is presented for obtaining the mean energy of energetic delta-rays arising when positive ions pass through tissue like matter; calculated values are compared with experiment.

11901 **(PNL-SA—12071) Monte Carlo calculation of energy deposition and ionization yield for high energy protons.** Wilson, W.E.; McDonald, J.C.; Coyne, J.J.; Paretzke, H.G. (Pacific Northwest Lab., Richland, WA (USA); National Bureau of Standards, Washington, DC (USA); Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Inst. fuer Strahlenschutz). Sep 1984. Contract AC06-76RL01830. 10p. (CONF-8409161—4). NTIS, PC A02/MF A01; GPO Dep. File Number DE85005518.

From 5. symposium on neutron dosimetry; Munich, F.R. Germany (17 Sep 1984).

Recent calculations of event size spectra for neutrons use a continuous slowing down approximation model for the energy losses experienced by secondary charged particles (protons and alphas) and thus do not allow for straggling effects. Discrepancies between the calculations and experimental measurements are thought to be, in part, due to the neglect of straggling. A tractable way of including stochastics in radiation transport calculations is via the Monte Carlo method and a number of efforts directed toward simulating positive ion track structure have been initiated

employing this technique. Recent results obtained with our updated and extended MOCA code for charged particle track structure (3) are presented here. Major emphasis has been on calculating energy deposition and ionization yield spectra for recoil proton crossers since they are the most prevalent event type at high energies (>99% at 14 MeV) for small volumes. Neutron event-size spectra can be obtained from them by numerical summing and folding techniques. Data for ionization yield spectra are presented for simulated recoil protons up to 20 MeV in sites of diameters 2 to 1000 nm. 10 references.

11902 **(SAND—84-1896) UPEML: a machine-portable CDC Update emulator.** Mehlhorn, T.A.; Young, M.F. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1984. Contract AC04-76DP00789. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85005299.

UPEML is a machine-portable CDC Update emulation program. UPEML is written in ANSI standard Fortran-77 and is relatively simple and compact. It is capable of emulating a significant subset of the standard CDC Update functions including program library creation and subsequent modification. Machine-portability is an essential attribute of UPEML. It was written primarily to facilitate the use of CDC-based scientific packages on alternate computer systems such as the VAX 11/780 and the IBM 3081.

6550 Medical Physics

REFER ALSO TO CITATION(S) 65500011648, 11898

11903 **(CONF-841003—1) Studies of a digital approach to neutron dosimetry and microdosimetry.** Turner, J.E.; Hamm, R.N.; Hurst, G.S.; Wright, H.A.; Chiles, M.M.; Greene, R.T. (Oak Ridge National Lab., TN (USA); General Electric Co., Clearwater, FL (USA)). 1984. Contract AC05-84OR21400. 10p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005371.

From Personnel radiation dosimetry symposium; Knoxville, TN, USA (15 Oct 1984).

A digital approach to neutron dosimetry is described. The paper reports on the initial Monte Carlo calculations of the detailed transport of protons and electrons in Ar, CH_4, and P-10 gases. 8 references, 10 figures, 1 table. (ACR)

11904 **(N—84-29479) Human exposure in low Earth orbit.** Wilson, J.W.; Cucinotta, F. (National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center). Aug 1984. 22p. (NASA-TP—2344; L—15803). NTIS, PC A02/MF A01.

Human exposure to trapped electrons and protons in low Earth orbit (LEO) is evaluated on a basis of a simple approximation of the human geometry for spherical shell shields of varying thickness. A data base is presented that may be used to make preliminary assessment of the impact of radiation exposure constraints on human performance. Detailed shielding studies should be performed before final design considerations. A sample impact assessment is discussed on the basis of presently accepted allowable exposure limits. A brief discussion is given on the anticipated impact of an ongoing reassessment of allowable exposure limits.

11905 **(PNL-SA—12703) Adequacy of current systems for monitoring extremity exposures at nuclear power plants.** Reece, W.D.; Harty, R. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1984. Contract AC06-76RL01830. 15p. (CONF-8410142—70). NTIS, PC A02/MF A01; GPO Dep. File Number TI85004546.

From 12. water reactor safety research information meeting; Gaithersburg, MD, USA (23 Oct 1984).

The adequacy of current extremity dosimetry methods is examined. The quantity that dosimetry systems should be measuring is defined. Irradiations using hand phantoms were performed to investigate the effect of high gradient fields on extremity monitoring systems. 6 figures. (ACR)

6560 Solid State Physics

REFER ALSO TO CITATION(S) 65600011389, 11942

11906 **(DOE/ER/40025—T2) Soliton energetics in extended Peierls-Hubbard models: a quantum Monte Carlo study.** Campbell, D.K.; DeGrand, T.A.; Mazumdar, S. (Los Alamos National Lab., NM (USA); Colorado Univ., Boulder (USA). Dept. of Physics). 1984. Contract AC02-81ER40025. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005409.

Using quantum Monte Carlo techniques, we study the effects of on-site (U) and nearest-neighbor (V) Hubbard interactions on the energetics of solitons in coupled electron-phonon (Peierls) models of quasi-one-dimensional materials. 11 references.

11907 **Absolute minimum of Landau's thermodynamic potential.** Kim, J.S. (California Institute of Technology, Pasadena, California 91125). *Physical Review [Section] B: Condensed Matter;* **31**: No. 3, 1433-1437(1 Feb 1985). Contract AC03-81ER40050.

We present a general method for finding the absolute minimum of Landau's thermodynamic potential. The method is illustrated in the example of the most general sixth-degree potential for a physical system whose order parameters transform as one of the three-dimensional vector representations of O/sub h/, O, and T/sub h/. The results are used to explain the three successive phase transitions occurring in $BaTiO_3$. The phase-transition conditions are obtained in an analytic form. We show why the perovskite-type crystals differ vastly in phase-transition properties even though their compositions are so similar.

11908 **Effect of a magnetic field on the vibrations of an ionic lattice.** Vineyard, G.H. (Brookhaven National Laboratory, Upton, New York 11973). *Physical Review [Section] B: Condensed Matter;* **31**: No. 2, 814-820(15 Jan 1985).

If an ionic solid is regarded as a vibrating lattice of point charges, a static magnetic field will exert a Lorentz force on each ion. In this paper the standard lattice dynamical theory is modified to allow for such forces, and a perturbation approach is developed. The frequencies of lattice vibrations and the velocity of propagation of acoustic waves are found to be perturbed, with the perturbation parameter being the ratio of the ion-cyclotron frequency in the magnetic field to the characteristic frequency of lattice vibrations. It is found that in non-centro-symmetric crystals the perturbation will be first order in this parameter (and hence in the magnetic field), while for centro-symmetric crystals, with certain exceptions, they will be second order. The exceptions are for degenerate modes, such as <100> and <110> propagation in cubic crystals, when a first-order effect which is quadratic in the wave number is predicted. The possibility of experimental measurements of the first-order effects is pointed out. A simple two-dimensional model is examined for more detailed illustration.

11909 **Interpretation of diffuse low-energy electron diffraction intensities.** Saldin, D.K.; Pendry, J.B.; Van Hove, M.A.; Somorjai, G.A. (The Blackett Laboratory, Imperial College, London SW72BZ, United Kingdom). *Physical Review [Section] B: Condensed Matter;* **31**: No. 2, 1216-1218(15 Jan 1985).

It is shown that the diffuse low-energy electron diffraction (LEED) that occurs between sharp LEED beams can be used to determine the local bonding configuration near disordered surface atoms. Two approaches to the calculation of diffuse LEED intensities are presented for the case of lattice-gas disorder of an adsorbate on a crystalline substrate. The capabilities of this technique are most similar to those of near-edge extended x-ray absorption fine structure, but avoid the restrictions due to the use of photons.

11910 **Optimum method of analysis of Faraday rotation and ellipticity measurements in a metal-oxide-semiconductor system.** O'Connell, R.F.; Wallace, G. (Louisiana State Univ., Baton Rouge). *Journal of Physics and Chemistry of Solids;* **44**: No. 10, 951-953(1983).

The Faraday rotation theta and ellipticity δ due to the two-dimensional electron gas at the oxide-semiconductor interface of a metal-oxide-semiconductor system was previously calculated. The results depend on such parameters of the system as the effective mass m*, the relaxation time tau, and the electron surface concentration N, and in fact the motivation is to enable one to determine such parameters from measurements of theta and δ. Here we discuss the optimum method for the determination of these parameters from the data. In particular, we argue that it is more desirable to carry out measurements at fixed magnetic field B and variable photon frequency omega, rather than at fixed omega and variable B. We also demonstrate how our analysis can be used to determine the predicted dependence of tau on magnetic field, without explicit knowledge of m* or N.

11911 **Theories of immiscible and structured mixtures.** Bedford, A.; Drumheller, D.S. (Univ. of Texas, Austin). *International Journal of Engineering Science;* **21**: No. 8, 863-960(1983).

A survey is given of continuum theories that have been developed to model mixtures of immiscible constituents, such as bubbly liquids, fluid-particle mixtures, fluid saturated porous media, and composite materials. It is emphasized that the immiscibility of such mixtures has important consequences concerning the forms of the constitutive equations, and that it can also result in the mixtures exhibiting microstructural effects. Brief descriptions are first given of the classical theory of mixtures - in which the constituents are not endowed with microstructure - and of theories of single continua with microstructure. The simplest theories of immiscible mixtures, in which the volume fractions of the constituents are introduced as additional kinematical variables, are then discussed, including postulated theories as well as theories that have been derived through various averging procedures. Theories of mixtures having greater microstructural content are described. Mixture theories that have been developed explicitly to model the behavior of composite materials are discussed.

6561 Superconductivity

REFER ALSO TO CITATION(S) 65610011324, 11355, 11357, 11411, 11420

11912 **(AD-A—143556/9) Studies of structural properties and their relationship to critical parameters in superconducting materials. Final report 1 October 1979-31 December 1983.** Kimball, C.W. (Northern Illinois Univ., Dekalb (USA). Dept. of Physics). 28 Feb 1984. 33p. NTIS, PC A03/MF A01.

The project comprised an experimental study of the electronic and vibrational properties of superconducting materials by means of Mossbauer spectroscopy. From the temperature dependence of the Mossbauer parameters of tin in the oxide superconductor Ba(Pb0.67Sn0.03)Bi0.3O3, phonon softening, characteristic of displacive transitions, was found to take place above the superconducting transition temperature. This observation is hence important for understanding the superconducting properties of the perovskite compounds. The Mossbauer effect at Sb121 in BaPb1-x(Bi,Sb)xO3 shows that Sb is 5+. The range of stability of the perovskite compounds was determined in the ternary systems Ba(Pb-Sn-Bi)O3 and Ba(Pb-Sb-Bi)O3. The composition dependence of the superconducting transition temperature was determined for both ternary systems. Conversion Electron Mossbauer Spectroscopy has been applied to the study of Nb3Sn superconducting films. This total has been found to provide a unique probe of the electronic and vibrational properties of thin film materials.

11913 **(LBL—17748) Superconducting junction with resonant tunneling.** Kresin, V.; Halbritter, J. (Lawrence Berkeley Lab., CA (USA); Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)). Sep 1984. Contract AC03-76SF00098. 7p. (CONF-840937—23). NTIS, PC A02. File Number DE85004900.

From Applied superconductivity conference; San Diego, CA, USA (9 Sep 1984).

In oxide coating metals, localized states exist, which strongly hybridize with conduction electrons forming interface states (IS). This hybridization yields several qualitative and quantitative new effects typical for oxide coated metals. The Hamiltonians for these new effects describe the: enhanced coupling of IS to phonons, strengthened and weakened superconducting interaction of IS, and additional - resonant - tunnel channels via IS. 25 references, 2 figures.

11914 **(LBL—18681) Macroscopic quantum tunnelling in a current biased Josephson junction.** Martinis, J.M.; Devoret, M.H.; Clarke, J.; Urbina, C. (Lawrence Berkeley Lab., CA (USA)). Nov 1984. Contract AC03-76SF00098. 6p. (CONF-841247—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE85004603.

From 4. simposio chileno de fisica; Santiago, Chile (26 Dec 1984).

We discuss in this work an attempt to answer experimentally the question: do macroscopic variables obey quantum mechanics. More precisely, this experiment deals with the question of quantum-mechanical tunnelling of a macroscopic variable, a subject related to the famous Schrodinger's cat problem in the theory of measurement.

11915 **(SAND—84-0959C) Transport studies of several novel organic conductors.** Kwak, J.F.; Azevedo, L.J.; Schirber, J.E.; Williams, J.M.; Beno, M.A. (Sandia National Labs., Albuquerque, NM (USA); Argonne National Lab., IL (USA)). 1984. Contract AC04-76DP00789. 10p. (CONF-841210—7). NTIS, PC A02/MF A01; GPO Dep. File Number DE85003950.

From International chemical congress of Pacific Basin Societies; Honolulu, HI, USA (16 Dec 1984).

We present the results of conductivity and thermopower measurements on several new conducting organic compounds. $(BEDT\text{-}TTF)_2BrO_4$ is isomorphous with the superconducting ReO_4 salt; our data show it to be metallic above 200°K and semiconducting below 100°K, although without any clear transition. In $(TMTSF)_2SiF_5$ the anion is neither octahedral nor tetrahedral; however, our results suggest behavior very like the octahedral salts. $(BEDT\text{-}TTF)_2InBr_4$ is semiconducting at room temperature with an activation energy of .12 eV. Low-temperature conductivity measurements on $(BEDT\text{-}TTF)_2I_3$ at 0.5 kbar show suppression of the known ambient-pressure superconducting state to below 1°K, and an anomaly at 7°K reminiscent of the CDW transition in $NbSe_3$.

11916 **Eilenberger equations for moderately dirty superconductors.** Kogan, V.G. (Ames Laboratory, Iowa State University, Ames, Iowa 50011). *Physical Review [Section] B: Condensed Matter;* **31**: No. 3, 1318-1323(1 Feb 1985). Contract W-7405-ENG-82.

Weak dependence of the Eilenberger Green's functions f(v) upon the direction v at the Fermi surface is explored to obtain equations for the averages $\langle f(v) \rangle = F$ over the Fermi surface. The derivation is similar to that of Usadel for the dirty limit. The proposed equations, however, are valid not only in the extreme dirty limit, but for "moderately dirty" samples too, i.e., in the case most often encountered in experiment. The formalism also describes superconductivity in a weak field for any impurity concentration and at any temperature.

6570 Theoretical Physics

REFER ALSO TO CITATION(S) 65700011574

11917 **(BONN-HE—84-17) Finite-size scaling for quantum chains with an oscillatory energy gap.** Hoeger, C.; Gehlen, G. von; Rittenberg, V. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). Jul 1984. 33p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85750293.

The existence of zeroes of the energy gap for finite quantum chains is shown to be related to a nonvanishing wavevector. Finite-size scaling ansaetze are formulated for incommensurable and oscillatory structures. The ansaetze are verified in the one-dimensional XY model in a transverse field.

11918 (UCRL—91408) Image formation in terms of the transport equation. Teague, M.R. (Lawrence Livermore National Lab., CA (USA)). 22 Oct 1984. Contract W-7405-ENG-48. 39p. (CONF-8409197—1). NTIS, PC A03/MF A01; GPO Dep. File Number DE85004993.

From Workshop on unconventional imagery; Rigi-Kaltbad-First, Switzerland (24 Sep 1984).

A scheme recovering phase using irradiance data alone, without interferometric techniques, is developed using the transport equations for phase and irradiance. For the case of one transverse dimension a general solution, for an arbitrary irradiance distribution, of the transport equation for the optical phase is already given by an application of the divergence theorem. Numerical simulations indicate that the phase recovery scheme works well even in the presence of large pupil plane aberrations if the signal to noise ratio is sufficiently high. In particular pupil plane phase aberrations may be determined from irradiance measurements in two planes which are near the image plane. 16 references, 20 figures.

11919 Scaling theory of desorption from molecular-sieve materials. Kerstein, A.R. (Sandia National Laboratories, Livermore, California 94550). *Physical Review [Section] B: Condensed Matter;* **31**: No. 3, 1612-1614(1 Feb 1985).

Molecular-sieve materials contain isolated macropore regions connected to the open macropore network by micropores which inhibit gaseous diffusion. We model the macroporosity as the allowed region of an uncorrelated site-percolation problem on a lattice. The scaling theory of percolation clusters above the percolation threshold is used to predict the long-time rate of gaseous desorption from molecular sieves. The analysis also predicts the transient electrical discharge from a random superconducting network.

11920 Microstructure of two-phase random media. V. The n-point matrix probability functions for impenetrable spheres. Torquato, S.; Stell, G. (Department of Mechanical and Aerospace Engineering and Department of Chemical Engineering, North Carolina State University, Raleigh, North Carolina 27695). *Journal of Chemical Physics;* **82**: No. 2, 980-987(15 Jan 1985).

We examine the two- and three-point matrix probability functions for a two-phase random and homogeneous system of impenetrable spheres. For such a system, we give an exact analytical expression for the two-point matrix function S_2 through second order in the number density of particles. Moreover, the two-point matrix function is evaluated, for the first time, for a very wide range of densities. We also discuss the evaluation of the three-point matrix function S_3 for an impenetrable-sphere system and provide new expressions that may be used to estimate it.

11921 Porosity and specific surface for interpenetrable-sphere models of two-phase random media. Rikvold, P.A.; Stell, G. (Department of Mechanical Engineering, State University of New York, Stony Brook, New York 11794). *Journal of Chemical Physics;* **82**: No. 2, 1014-1020(15 Jan 1985).

We derive and numerically evaluate expressions for the porosity (matrix volume fraction) phi and the specific surface (interface area per unit volume) s for two specific models of a random two-phase medium in which the medium is considered as a suspension of interpenetrable spheres of radius R, embedded in a uniform matrix. The models and quantities considered have applications to a wide range of problems concerning transport, mechanical, and chemical properties of composite media. Both models contain a continuously variable hardness parameter epsilon-c, such that for epsilon-c = 1 they reduce to mutually impenetrable spheres, and for epsilon-c = 0 they reduce to fully penetrable spheres. The first of these models, the permeable-sphere model, has been defined only in the context of the Percus—Yevick approximation, which yields for it a unique pair distribution function $g_2(r_1, r_2)$. To find the associated g/sub n/(r$_1$,...,r/sub n/) for n>2, which are needed to evaluate phi and s we use the generalized superposition approximation. The second model, the concentric-shell model, can be fully defined without recourse to any particular approximation and proves to be isomorphic to the picture described by the scaled-particle theory of Reiss, Frisch, and Lebowitz. In this case we evaluate phi and s in the scaled-particle approximation introduced by those authors to implement the scaled-particle theory. For both models, we present numerical plots of phi vs dimensionless density, and of s vs phi. We also briefly discuss the relations between the results obtained in the two cases.

11922 Perturbation theory of classical equilibrium fluids. Kang, H.S.; Lee, C.S.; Ree, T.; Ree, F.H. (Department of Chemistry, Korea Advanced Institute of Science and Technology, P.O. Box 150 Chongyangni, Seoul, Korea). *Journal of Chemical Physics;* **82**: No. 1, 414-423(1 Jan 1985).

A new perturbation theory which is reliable over a wide fluid region is presented. The new theory reduces to the theory of Weeks, Chandler, and Anderson at densities near or below the triple point density of a simple fluid but it can also accurately predict thermodynamic properties at higher densities near the freezing line of the fluid. This is done by employing an optimized reference potential whose repulsive range decreases with increase in density. Thermodynamic properties for Lennard-Jones, exponential-6, and inverse nth-power (n = 12, 9, 6, and 4) potentials have been calculated from the new theory. Comparison of the calculated data with available Monte Carlo simulations and additional simulations carried out in this work shows that the theory gives excellent thermodynamic results for these systems. The present theory also gives a physically reasonable hard-sphere diameter over the entire fluid range.

11923 Effect of noise on time-dependent quantum chaos. Ott, E.; Antonsen T.M. Jr.; Hanson, J.D. (Laboratory for Plasma and Fusion Energy Studies, University of Maryland, College Park, Maryland 20742). *Physical Review Letters;* **53**: No. 23, 2187-2190(3 Dec 1984).

The dynamics of a time-dependent quantum system can be qualitatively different from that of its classical counterpart when the latter is chaotic. It is shown that small noise can strongly alter this situation.

11924 New scalar potential formulation of the magnetostatic field problem. Pasciak, J.E. (Santa Barbara Research Center, Goleta, California 93117). *Mathematics of Computation;* **43**: No. 168, 433-446(Oct 1984). Contract AC02-76CH00016.

A new method for approximating magnetostatic field problems is given in this paper. The new method approximates the scalar potential for the magnetic intensity and is based on a volume integral formulation. The derivation of the new computational method uses the spectral properties of the relevant integral operator. The corresponding algorithm is similar to that obtained from coupled differential and boundary integral approaches. Convergence and stability theorems are proven. Finally, convergence results in actual computations are compared with results for the usual volume integral method used in GFUN3D.

11925 Spectral properties for the magnetization integral operator. Friedman, M.J.; Pasciak, J.E. (Santa Barbara Research Center, Goleta, California 93117). *Mathematics of Computation;* **43**: No. 168, 447-489(Oct 1984). Contract AC02-76CH00016.

We analyze the spectrum of a certain singular integral operator on the space $(L^2(\Omega))^3$ where Ω is contained in three dimensional Euclidean space and has a Lipshitz continuous boundary. This operator arises in the integral formulation of the magnetostatic field problem. We decompose $(L^2(\Omega))^3$ into invariant subspaces: in one where the operator is the zero map; in one, the identify map; and in one where the operator is positive definite and bounded. These results give rise to the formulation of new efficient numerical techniques for approximately nonlinear magnetostatic field problems [5], [6], [12].

6580 Mathematical Physics

REFER ALSO TO CITATION(S) 65800011924, 11925, 11985

11926 (CONF-841255—1) Sparse matrix computations. Heath, M.T. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004780.

From 23. IEEE conference on decision and control; Las Vegas, NV, USA (12 Dec 1984).

Numerical linear algebra plays a vital role in all parts of computational methematics, such as differential equations and optimization, and in many application areas, such as control theory. Large systems in these areas generally lead to linear algebra problems involving large sparse matrices (i.e., matrices of large dimension, but whose entries are mostly zeros). Efficient use of computer resources in solving such sparse matrix problems requires special techniques which have a distinct flavor compared to those used for dense matrices. We survey the current state of the art in sparse matrix computations, including the solution of systems of linear algebraic equations, linear least squares problems, and eigenvalue problems. Emphasis is placed on direct methods, but iterative methods are also considered. We also emphasize the concrete and useful expression of algorithms in the form of computer software.

11927 (CONF-8403108—2) Macro for fitting nonlinear models to Poisson distributed data. Frome, E.L.; McLain, R. (Oak Ridge National Lab., TN (USA); Oak Ridge Associated Universities, Inc., TN (USA)). 1984. Contract AC05-84OR21400. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE84008569.

From SUGI conference; Hollywood, FL, USA (18 Mar 1984).

Models are considered in which the dependent variable y is a count that follows the Poisson distribution. The expected value of y is represented with a regression function that describes the relation between the expected count, the predictor variables, and the parameters. Estimates of the parameters can be obtained using iteratively weighted least squares (IWLS). The IWLS procedure is equivalent to using the method of scoring to obtain a root of the likelihood equations. Poisson regression models include linear, log-linear, quasi-linear, and intrinsically nonlinear regression functions. This approach allows the analyst to concentrate on determining the most appropriate form of the regression function without regard for computational complexity. The SAS procedures NLIN and MATRIX can be used to obtain ML estimates, their estimated asymptotic covariance matrix, and diagnostic measures that can be used to aid the analyst in detecting outlying responses and extreme points in the model space. An example, using an intrinsically nonlinear model (derived from the theory of Dual Radiation Action), is used to illustrate the ML estimation, hypothesis testing, and regression diagnostics techniques.

11928 (SAND—84-2526C) Parametric coherence estimation via convolved correlations. Cadzow, J.A.; Solomon, O.M. Jr.; Stearns, S.D. (Sandia National Labs., Albuquerque, NM (USA); Arizona State Univ., Tempe (USA). Dept. of Electrical and Computer Engineering). 1985. Contract AC04-76DP00789. 12p. (CONF-850399—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85003946.

From International conference on acoustics, speech and signal processing (ICASSP); Tampa, FL, USA (26 Mar 1985).

In this paper, the magnitude squared (MS) coherence is computed by estimating the parameters of a single polynomial ratio. The parameters are constrained so that the estimated MS coherence is real-valued on the unit circle. The method first estimates the auto- and cross-correlation lags from raw data sequences. The auxiliary sequences [a(n)] and [b(n)] are defined as the convolution of the cross-correlation function with itself and the convolution of the two autocorrelation functions, respectively. The MS coherence parameters will nearly satisfy a homogeneous set of equations involving the sequences [a(n)] and [b(n)]. This system of linear equations is solved via an eigenspace decomposition. The algorithm is compared with two traditional periodogram based estimation methods.

11929 (UCRL—15646) Algorithms and software for pole assignment and observers. Laub, A.J.; Wette, M. (California Univ., Santa Barbara (USA). Dept. of Electrical and Computer Engineering). Sep 1984. Contract W-7405-ENG-48. 21p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85006157.

This is a final report for a project entitled Algorithms and Software for Pole Assignment and Observers. The work consisted of evaluating some algorithms and software for pole placement and producing some software for full-order observers. Several promising pole placement approaches were tried and extensive numerical testing was done. This is documented in detail later in the report. A suite of programs to implement full-order observer design, as well as stand-alone pole placement software, has been written and documented and is also described in detail in the sequel. Both single-input and multi-input pole placement were investigated with considerable effort being devoted to writing code for the latter for which no reliable codes were already available. Time did not permit writing and testing of code to do minimal order observers but such a project looks feasible and may be undertaken independently by the authors.

70 FUSION ENERGY

7001 Plasma Research

11930 (DOE/ET/51013—134) TARA diagnostic set. Sevillano, E.; Brau, K.; Goodrich, P.; Irby, J.; Mauel, M.E.; Post, R.S.; Smith, D.K.; Sullivan, J.; Trulsen, J. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). Sep 1984. Contract AC02-78ET51013. 13p. (PFC/CP—84-15; CONF-840922—20). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004845.

From 5. APS topical conference on high temperature plasma diagnostics; Tahoe City, CA, USA (16 Sep 1984).

The TARA Tandem Mirror Experiment has recently begun operation. The set of diagnostics available at this time is discussed. The following diagnostics are now in use: diamagnetic loops, a multi-chord microwave interferometer, Langmuir and emissive probes, pick-up loops, and secondary emission detectors. Endloss diagnostics include net current detector arrays, Faraday cup arrays, swept particle analyzer arrays, and calorimetry. Light emission measurements are made in the visible and VUV regions. A multi-chord fiber-optic array for plasma position detection is also used. In addition, a 3-channel charge-exchanger analyzer, a hard x-ray system, and fast pressure gauges are available.

11931 (DOE/ET/53043—T2) Initial bolometric measurements on text. Snipes, J.A.; Bora, D.; Kochanski, T.P. (Texas Univ., Austin (USA). Fusion Research Center). Dec 1984. Contract AC05-78ET53043. 28p. (FRCR—269). NTIS, PC A03/MF A01; GPO Dep. File Number DE85004599.

A platinum resistance bolometer has been used to measure the total radiated power in TEXT. Preliminary attempts to determine the scaling of the total radiated power with impurity content, toroidal field, electron density, and plasma current have been made. These measurements indicate that the radiated power is strongly dependent on the impurity content, proportional to the plasma current and electron density, and inversely proportional to the toroidal field. The density and toroidal field dependences are apparently connected with changes in impurity confinement with these parameters. Increases in total radiated power during different impurity injections have also been measured. Shot to shot radial scans of the bolometer across the plasma have been made for several plasma conditions. Estimates of the total radiated power have also been made for these conditions. Comparisons with the ohmic heating input power show that the radiated power is a large percentage of the input power, so that the radiated power is a significant term in thermal transport calculations. This report describes the experimental techniques used and preliminary results of the power measurements.

11932 **(DOE/ET/53088—162) Fast alpha particle distribution function in an open field-line plasma with electrostatic confining potential.** Hamnen, H.; Hanson, J.D. (Texas Univ., Austin (USA). Inst. for Fusion Studies). Nov 1984. Contract FG05-80ET53088. 19p. (IFSR—162). NTIS, PC A02/MF A01; GPO Dep. File Number DE85005554.

An appropriate solution to the Fokker-Planck equation for the alpha-particle distribution function in an open field-line fusion plasma with electrostatic confining potential is presented. Particle and energy pitch-angle scattering losses are computed. The electrostatic confining potential is found to substantially reduce particle and energy losses.

11933 **(IPP-III—98) Analysis of local transport in neutral-beam-heated L and H plasmas of ASDEX.** Becker, G.; Bernhardi, K.; Eberhagen, A.; Fussmann, G.; Gehre, O.; Gernhardt, J.; Gierke, G. von; Glock, E.; Haas, G.; Karger, F. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)). Jun 1984. 20p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85750303.

A well-diagnosed series of high-confinement (H) discharges in ASDEX is studied in detail by transport modelling. Computed temperature and density profiles in the Ohmic and H phases are compared with measurements. Profiles for the electron heat diffusivity chisub(e), diffusion coefficient D and inward drift velocity vsub(in) are determined for the whole plasma including the scrape-off zone. Empirical scaling relations of these quantities in the L and H regimes are presented. The development of density and temperature profiles after transition to the H phase is investigated. The inward drift with neutral injection is studied.

11934 **(KFK—3756) Influence of gradual density transition and nonlinear saturation on Rayleigh-Taylor instability growth.** Jacobs, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik). Aug 1984. 80p. NTIS (US Sales Only), PC A05/MF A01. File Number DE85750300.

Linear theory of Rayleigh-Taylor instability growth at a density profile which varies exponentially between regions of constant density is discussed in detail. The exact theory provides an approximate but conservative simple formula for the growth constant and it shows that a hitherto widely used theory erroneously underestimates the growth constant. A simple but effective "synthetical model" of nonlinear bubble growth is obtained from a synthesis of linear theory and constant terminal bubble speed. It is applied to pusher shell break-up in an inertial confinement fusion pellet to determine the maximum allowable initial perturbations and the most dangerous wavelength. In a situation typical of heavy ion drivers it is found that the allowable initial perturbations are increased by a few orders of magnitude by the gradual density transition and another order of magnitude by nonlinear saturation of the bubble speed. The gradual density transition also shifts the most dangerous wavelength from about once to about four times the minimum pusher shell thickness. The following topics are treated briefly: Reasons conflicting with use of the synthetical model to decide whether the pusher shell in a certain simulation will be broken up; other nonlinear theories available in the literature; further realistic effects that might aggravate instability growth.

11935 **(LBL—18010) Laser-induced fluorescence of metal-atom impurities in a neutral beam.** Burrell, C.F.; Pyle, R.V.; Sabetimani, Z.; Schlachter, A.S. (Lawrence Berkeley Lab., CA (USA)). Oct 1984. Contract AC03-76SF00098. 9p. (CONF-841218—15). NTIS, PC A02/MF A01; GPO Dep. File Number DE85004980.

From 31. national vacuum symposium; Reno, NV, USA (3 Dec 1984).

The need to limit impurities in fusion devices to low levels is well known. We have investigated, by the technique of laser-induced fluorescence, the concentration of heavy-metal atoms in a neutral beam caused by their evaporation from the hot filaments in a conventional high-current multifilament hydrogen-ion source.

11936 (ORNL/TM—9110, pp 17-38) **Magnetics, single-particle drift orbits, and nonresonant electron transport coefficients for the ELMO Bumpy Square.** Owen, L.W. Oct 1984. NTIS, PC A11/MF A01. File Number DE85000664.

In ELMO Bumpy Square.

The ELMO Bumpy Square (EBS) is formed by four linear arrays of simple magnetic mirrors linked by 90° sections of a high-field toroidal solenoid. The EBS is shown o have single-particle confinement properties that are distinctly superior to those of a standard EBT consisting of a toroidally linked array of circular mirror coils. Specifically, EBT-I/S is compared to EBS configurations having 24 mirror sectors with EBT-I/S mirror coils in the sides of the square. Each corner is formed by eight new circular or elliptical coils that generate a field with negligible edge ripple, so that trapping in local minima in the corners does not occur.

11937 (ORNL/TM—9110, pp 73-148) **Introduction to magnetic equilibria and single-particle orbits in the square configuration of EBT: a tutorial.** Hedrick, C.L.; Owen, L.W. Oct 1984. NTIS, PC A11/MF A01. File Number DE85000664.

In ELMO Bumpy Square.

Here we discuss the ideal magnetohydrodynamic (MHD) magnetic equilibrium properties and single-particle orbit characteristics of the square configuration of ELMO Bumpy Torus (EBT). The intent is to make this aspect of the theory accessible to those unfamiliar with the general aspects of EBT theory. In particular, we attempt to include sufficient detail to enable the interested reader to reproduce the analytic development without excessive effort. Recognizing that many will not have the time or inclination for such an effort, most of the main features are discussed briefly in the introduction. The more formal developments, as well as what we have found to be useful interpretations of the mathematics, are contained in the body of the text. So as not to obscure the basic arguments unduly with algebraic detail, lengthy mathematical developments have been relegated to appendixes.

11938 (ORNL/TM—9110, pp 149-156) **Stability of the ELMO Bumpy Square.** Spong, D.A. Oct 1984. NTIS, PC A11/MF A01. File Number DE85000664.

In ELMO Bumpy Square.

A brief review of theoretical work on the EBS is given. The various possible instabilities are briefly described. (MOW)

11939 (ORNL/TM—9110, pp 157-180) **MHD ballooning modes in the ELMO Bumpy Torus.** Hedrick, C.L. Oct 1984. NTIS, PC A11/MF A01. File Number DE85000664.

In ELMO Bumpy Square.

The MHD stability properties of the square configuration are analyzed here. In particular, limitations on core plasma beta due to ballooning modes are developed. The restrictions on core plasma beta are found to be comparable to those of the Lee-Van Dam-Nelson limit.

11940 (ORNL/TM—9110, pp 181-208) **Ballooning modes in the ELMO Bumpy Square configuration using the generalized kinetic energy principle.** Spong, D.A. Oct 1984. NTIS, PC A11/MF A01. File Number DE85000664.

In ELMO Bumpy Square.

In the bumpy square configuration, toroidal curvature is localized in the corner sections rather than uniformly distributed, as is the case in the existing circular ELMO Bumpy Torus (EBT) configuration. This feature, coupled with the fact that the magnetic field is higher in the corner sections, results in a number of distinct advantages with respect to particle confinement, heating, and transport. It might be expected, however, that ballooning modes should have some tendency to concentrate in the corner sections - especially along the outer field lines where the curvature and pressure gradients are unfavorable. Here we examine the stability of such a configuration using a ballooning mode equation derived from the generalized kinetic energy principle. The side and corner sections of the square are treated with a piecewise constant approximation and matched at a transition boundary to obtain the stability condition. This retains the ring-core coupling and yields both the low β/sub c/ diamagnetic well stabilization condition and a high-β/sub c/ stability limit analogous to the Lee-Van Dam-Nelson β/sub c/ limit, where β/sub c/ is the core plasma beta. Due to the high magnetic field in the corners and the relatively weak curvature there ($\simeq$ 1/2 of the curvaure in the bumpy sections), this upper β/

sub c/ limit is not significantly changed from that which would be present in the conventional circular bumpy torus configuration.

11941 **(PB—84-224849) Absolute fission chambers for high-energy neutron fields. Final report.** Gilliam, D.M.; Schroder, I.G. (National Bureau of Standards, Washington, DC (USA)). Nov 1982. 2p. Pub. in Proceedings of 1982 Winter Meeting, American Nuclear Society, Washington, DC, November 14-18, 1982, Transactions 43, p286-287.

The neutron diagnostics systems for both the Tokamak Fusion Test Reactor and the Joint European Torus will use fission ionization chambers for observing the time profiles of neutron production. These systems cover wide dynamic ranges (9 to 12 orders of magnitude) by a combination of the pulse-counting and current modes of operation. The present paper discusses the advantages and possibilities of extending the pulse-counting mode as high as possible into the dynamic range for neutron diagnostics in high-energy neutron fields. A limit of the order of 10 to the 12th power n/((sq cm)sec) is estimated from past fission chamber developments and the present calculations of charged particle emissions.

11942 **(PB—85-110237/XAB) Bulletin of the Electrotechnical Laboratory, Volume 48, No. 7, July 1984.** (Electrotechnical Lab., Ibaraki (Japan)). Jul 1984. 97p. (In Japanese). NTIS, PC E05/MF E01.

See also PB85-110245 and PB85-109338.

This issue contains the following papers: Electron Temperature and Density of Reversed Field Pinch Plasma in TPE-1R (M); Ion Temperatures of Reversed Field Pinch Plasmas in TPE-1R (M) from D(a) Line Doppler Broadening; Microwave Scattering from Tapped Water Wave and Oil Pollution; Characteristics of Standard Cells at 0 deg C.; The Interaction between Lattice Distortion and Optical Phonon Mode; On the Machine Learning and Understanding of Drawings; Some Technical Points in Conversion from VTAM-F to VTAM-G. I. In VTAM Application Programs for Online Measurement, Code-Independent Transmission, or Mass Data Transmission.

11943 **(PPPL—2170) Fusion gamma diagnostics.** Medley, S.S.; Cecil, F.E.; Cole, D.; Conway, M.A.; Wilkinson, F.J. III. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Dec 1984. Contract AC02-76CH03073. 14p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005344.

Nuclear reactions of interest in fusion research often possess a branch that yields prompt emission of gamma radiation in excess of 15 MeV. This branch can be exploited to provide a new fusion reaction diagnostic having applications similar to conventional neutron emission measurements. Conceptual aspects of fusion gamma diagnostics are discussed with emphasis on application to TFTR during deuterium neutral beam heating of D-T and D-^{3}He plasmas. Recent measurements of the D(T, γ)^{5}He, D(^{3}He, γ)^{5}Li, and D(D, γ)^{4}He branching ratios at low center-of-mass energy (30 to 100 keV) and of the response of a large volume Ne226 detector for gamma detection in high neutron backgrounds are presented. For a well-shielded Ne226 detector, the D(T, γ)^5 He gamma signal level during 20 MW to 120 keV deuterium neutral beam heating of a TFTR tritium plasma was estimated to be 3.5 x 10^5 CPS.

11944 **(PPPL—2171) Far-infrared laser scattering in the ACT-I toroidal device.** Goree, J.; Mansfield, D.K.; Ono, M.; Wong, K.L. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Dec 1984. Contract AC02-76CH03073. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005341.

A far-infrared laser scattering diagnostic has been built for the ACT-I toroidal device. The optical system uses a passively stabilized 447-μm CH_3I laser. A polyethylene etalon is the beam splitter. The vacuum windows are plastic (TPX), which we found has the vacuum property Q 6.5 x 10^{-9} torr-liter/sec/cm^2. Using paraboloidal and ellipsoidal mirrors for detection optics improves the signal strength and allows a better rf enclosure design for the detector. The diagnostic was tested by scattering from an ion Bernstein wave, a technique which can be used for ion temperature diagnostics.

11945 **(PPPL—2177) Parasitic excitation of ion Bernstein waves from a Faraday shielded fast wave loop antenna.** Skiff, F.; Ono, M.; Colestock, P.; Wong, K.L. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Dec 1984. Contract AC02-76CH03073. 24p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005352.

Parasitic excitation of ion Bernstein waves is observed from a Faraday shielded fast wave loop antenna in the ion cyclotron frequency range. Local analysis of the Vlasov-Maxwell equations demonstrates the role of plasma density gradient in the coupling process. The effects of plasma density and of parallel wave number on the excitation process are investigated.

11946 **(PPPL—2178) Observation of the backward electrostatic ion cyclotron wave.** Goree, J.; Ono, M.; Wong, K.L. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Dec 1984. Contract AC02-76CH03073. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85005340.

The backward branch of the electrostatic ion cyclotron wave has been observed, we believe, for the first time. The wave, which was driven by a phased antenna structure inserted in a neon plasma, exists in the parameter ranges 2T/sub i//m/sub i/ << (ω/k/sub parallel/)^2 << 2T/sub e//m/sub e/, nΩ/sub i/ < ω < (n+1)Ω/sub i/, T/sub e/ $\geqq$ T/sub i/, and ω/sub pi/ > Ω/sub i/. Double-tip probe interferomety data agree with the theoretical dispersion relation.

11947 **(TRITA-PFU—83-07) Proposed 14-MeV neutron spectrometer system for jet.** Elevant, T. (Royal Inst. of Tech., Stockholm (Sweden). Plasma Physics and Fusion Research). Sep 1983. 22p. Royal Inst. of Tech., Plasma Physics and Fusion Research, Stockholm, Sweden.

In order to cover a broad range of neutron spectra and fluxes during D-T operation in JET we propose the use of two different detector techniques neutron induced reactions in a silicon surface barrier detector and neutron-proton elastic scattering in a liquid scintillator. Experimental investigations of ^{28}Si(n,α)^{25}Mg reactions have resulted in resolutions of ΔE(FWHM)/E=0.02 with intrinsic efficiency equal to 10^{-4} and a maximum useful count-rate equal to 1600 c.p.s. However, due to overlap of adjacent peaks, caused by excited states of ^{25}Mg, this spectrometer has an operation range limited to FWHM/E=0.04. For broader neutron distributions we propose the use of a conventional liquid scintillator system with a light guide, photomultiplier tube and modified conventional electronics. Experiments have demonstrated a resolution equal to 0.05 and a n/γ separation better than 90 percent at total count-rates equal to 2 times 10^5 c.p.s.

11948 **Stabilization of interchange modes in mirror plasma devices by radio-frequency sideband coupling.** McBride, J.B.; Stefan, V.; Krall, N.A. (Science Applications International Corporation, La Jolla, California). *Physical Review Letters;* **54**: No. 1, 42-45(7 Jan 1985).

We present results from an analysis of the ion cyclotron range of frequencies (ICRF) wave interactions with flute-interchange modes. The analysis is valid for arbitrary wave vector of the ICRF waves, and shows that these modes can be stabilized by ICRF sideband coupling to them. The modes can be stabilized in a variety of ways, depending on details of the ICRF wave structure. We also find a new rf-driven fluid instability for a range of parallel (to the magnetic field) rf wavelengths.

11949 **J x B heating by very intense laser light.** Kruer, W.L.; Estabrook, K. (University of California, Lawrence Livermore National Laboratory, Livermore, California 94550). *Physics of Fluids;* **28**: No. 1, 430-432(Jan 1985). Contract W-7405-ENG-48.

Plasma heating by the oscillating component of the pondermotive force of a very intense light wave is discussed.

11950 **Differential equation for the ambipolar electric field in a multiple-helicity torsatron.** Hastings, D.E. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Physics of Fluids;* **28**: No. 1, 334-337(Jan 1985). Contract AC05-84OR21400.

In a torsatron, the ambipolar electric field is obtained by equating the ion and electron fluxes. This formulation, when solved simultaneously with the density and temperature rate equations, gives continuous electric fields but may lead to the radial derivative of the electric field being discontinuous. This unphysical situation arises from the neglect of the finite orbit deviation from the flux surfaces. If the fluxes are calculated to higher order in inverse aspect ratio to include the finite orbit deviation, then a second-order differential equation is obtained that will give a continuous first derivative for the electric field.

11951 **Simulation of phase space hole growth and the development of intermittent plasma turbulence.** Berman, R.H.; Tetreault, D.J.; Dupree, T.H. (Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Physics of Fluids;* **28**: No. 1, 155-176(Jan 1985).

An unstable, highly intermittent state of turbulence is observed to evolve from a quiescent homogeneous plasma that is linearly stable. This intermittent state, which consists of isolated phase space density holes, produces a pronounced non-Gaussian distribution of fluctuation amplitudes. The skewness becomes increasingly more negative with time. The plasma is nonlinearly unstable because the holes grow in amplitude by accelerating to regions of higher average phase space density. The instability can be interpreted as a collection of colliding, growing holes and, in its early stages, is consistent with theoretical predictions for the clump instability. A series of runs with a single isolated hole indicates that an isolated hole grows for any finite electron-ion drift velocity. The isolated hole growth rate is consistent with theoretical predictions. The implications of the instability to laboratory and space plasma are discussed.

11952 **Two-dimensional Lasnex ray-trace calculations of thermal whole beam self-focusing.** Estabrook, K.; Kruer, W.L.; Bailey, D.S. (University of California, Lawrence Livermore National Laboratory, Livermore, California 94550). *Physics of Fluids;* **28**: No. 1, 19-21(Jan 1985). Contract W-7405-ENG-48.

Thermal self-focusing of laser light may be significant when a plasma is irradiated with short-wavelength laser light. Self-focusing magnifies the light intensity which can increase absorption by plasma waves (producing hot electrons which may cause preheat), could increase scattering, and could be a perturbation source for the Rayleigh—Taylor instability. We use two-dimensional hydrodynamic simulations to characterize thermal self-focusing for parameters of interest to laser fusion applications, and present a simple model. A diverging beam is shown to reduce the self-focusing.

11953 **Nonlinear interaction of tearing modes: A comparison between the tokamak and the reversed field pinch configurations.** Holmes, J.A.; Carreras, B.A.; Hender, T.C.; Hicks, H.R.; Lynch, V.E.; An, Z.G.; Diamond, P.H. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Physics of Fluids;* **28**: No. 1, 261-270(Jan 1985). Contract W-7405-ENG-26.

The multiple helicity nonlinear interaction of resistive tearing modes is compared for the tokamak and reversed field pinch configurations using the magnetohydrodynamic equations. Unlike the case of the tokamak disruption, for which this interaction is destabilizing when islands overlap, the nonlinear coupling of the dominant helicities is shown to be a stabilizing influence in the reversed field pinch. The behavior of the coupled instabilities in the two configurations can be understood as a consequence of the stability properties of the nonlinearly driven modes. In the case of the tokamak disruption, quasilinear effects linearly destabilize the dominant driven mode, which then feeds energy to the driving mode. For the reversed field pinch the driven modes remain stable, acting as a brake on the growth of the dominant instabilities. Furthermore, for the reversed field pinch configuration, numerical results indicate that nonlinear coupling of different helicities results in noticeably more rapid saturation of the dominant instabilities than was observed in single helicity studies.

11954 **Effect of Coulomb collisions on universal mode stability.** Beasley, C.O.; van Rij, W.I.; Molvig, K. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831). *Physics of Fluids;* **28**: No. 1, 271-274(Jan 1985). Contract AC05-84OR21400.

The effect of electron—ion Coulomb collisions on the universal mode is studied using a Fokker—Planck collision operator in the kinetic equation for the electron distribution f/sub parallele/(x,v/sub parallel/,t). The expected smoothing of the v/sub parallel/ structure of f/sub parallele/ is found, and the character of the mode is little changed when ν/sub e/i$\rightarrow\omega$/sub asterisk/. It is also confirmed that a collisionality on the order of that of present tokamaks is sufficient to provide for destabilization of the mode even in the absence of nonlinear orbit stochastic diffusion.

11955 **Analytic theory of stable resistive magnetohydrodynamic modes.** Pao, Y.; Kerner, W. (Courant Institute of Mathematical Sciences, New York University, 251 Mercer Street, New York, New York 10012). *Physics of Fluids;* **28**: No. 1, 287-293(Jan 1985). Contract AC02-76ER03077.

The spectrum of stable resistive magnetohydrodynamic modes is shown to be determined by the geometry of anti-Stokes lines. Behavior of the eigenfunctions is also examined.

11956 **Proton spectra diagnostics for shock-compression studies.** Welch, D.R.; Harris, D.B.; Bennish, A.H.; Miley, G.H. (Fusion Studies Laboratory, Nuclear Engineering Program, University of Illinois, 103 South Goodwin Avenue, Urbana, Illinois 61801). *Applied Physics Letters;* **45**: No. 12, 1284-1286(15 Dec 1984). Contract AC08-80DP40124.

The energy spectra of fusion products escaping long-pulse-length laser-imploded deuterium-tritium filled glass microballoons have been measured with a time-of-flight spectrometer. The D(d,p)T reaction proton energy spectra showed two distinct peaks, indicating two burn phases in the target. The first burn phase is attributed to a spherically converging shock, while the second is attributed to subsequent compression heating. The analysis of these spectra provides the first conclusive proof of significant compression yields in these targets, where approximately half of the yield occurs during the compression burn phase.

11957 **Monte-Carlo study of ICRF-sustained mode operation in tandem mirrors.** Todd, A.M.M. (Grumman Aerospace Corp., Princeton, NJ (USA)). *Nuclear Fusion;* **24**: No. 9, 1183-1194(Sep 1984).

A study, using a Monte-Carlo simulation code, of ICRF-sustained mode operation in tandem mirrors by way of ICRF end-cell fuelling and heating is described. Although the basic parameter space considered corresponds to the Phaedrus experiment, the central-cell density and temperatures are extended towards the reactor regime. It is found that significant end cell ion potential barriers can be generated with ICRF, but that, owing to choking of the central-cell ion source stream by the plugging potential, saturation occurs and power requirements rapidly increase, so that the potential rise is limited to about twice the central-cell ion temperature. Although performance is improved as the ion cyclotron resonance approaches the end-cell mid-plane, no significant difference is found between inboard, outboard or double resonance location. As the central-cell density and temperatures are increased, the RF power requirement is found to increase dramatically. Optimum performance for end cell fuelling results when the central-cell electron temperature is higher than the ion temperature, but the magnitude of this ratio is limited by an increase in threshold power level with electron temperature.

11958 **Observations of low-frequency plasma fluctuations in the Elmo Bumpy Torus.** Komori, A. (Oak Ridge National Lab., TN (USA)). *Nuclear Fusion;* **24**: No. 9, 1173-1182(Sep 1984).

Fluctuations in the DC frequency range up to 400 kHz are studied in the Elmo Bumpy Torus (EBT-I) plasma. Special attention is paid to the effect of microwave-heated hot-electron rings on the fluctuations, and the fluctuations of the toroidal plasma around the hot-electron rings are found to be reduced to a low level. This reduction is also related to changes in the density gradient, and the

predictions of a density-gradient-driven drift wave theory are examined. In the surface plasma surrounding the toroidal plasma, two types of fluctuations are observed: fluctuations with properties similar to those of the density-gradient-driven drift wave and electromagnetic fluctuations localized in the outer plasma along the hot-electron rings.

11959 **Transport of injected impurities in Heliotron E.** Rice, J.E.; Terry, J.L.; Marmar, E.S. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center) (and others). *Nuclear Fusion;* **24**: No. 9, 1205-1211(Sep 1984).

Letter-to-the-editor.

Impurities have been injected into Heliotron E in order to study the transport properties of currentless plasmas. In ECH-produced plasmas, the observed impurity transport can be described by purely anomalous diffusion, with a coefficient of the order of $D=2000\text{-}5000 cm^2.s^{-1}$. During neutral beam operation, the impurity transport can be characterized by considerably weaker diffusion, combined with inward convection. Convection velocities as large as a few hundred centimetres per second are inferred.

11960 **Suppression of flute instability in an axisymmetric double-cusp plasma by RF ponderomotive force.** Parks, P.B.; Baker, D.R. (GA Technologies, Inc., San Diego, CA (USA)). *Nuclear Fusion;* **24**: No. 9, 1149-1157(Sep 1984).

An analysis is made of the stabilizing effect of a radial ponderomotive force on the interchange mode in a double-cusp mirror plasma which has unfavourable curvature on internal flux surfaces. A cavity mode in the long central cell region is set up by exciting electromagnetic ion cyclotron waves and it provides the radial force which opposes the curvature drive. Application of this method to RFC-XX shows that the ICRH power needed for stabilization is comparable to that needed for heating.

11961 **Collisional transport of momentum in axisymmetric configurations.** Hogan, J.T. (Oak Ridge National Lab., TN). *Physics of Fluids;* **27**: No. 9, 2308-2312(Sep 1984). Contract W-7405-ENG-26.

Calculations of the cross-field transport of toroidal momentum are presented for the collision-dominated regime in devices with an axisymmetric magnetic configuration. Intended as a point of reference for more complex calculations of transport in the low collision frequency regime, the development treats the case of pure toroidal flow and closely parallels previous calculations of collisional thermal conductivity in tokamaks. Certain counter-intuitive features of previous fluid-regime calculations of momentum diffusion are removed, and the contribution of viscous heating to the ion energy balance is discussed. A relation between internal disruptions (sawtooth oscillations) and momentum transport is proposed.

11962 **Electron transport in the ELMO bumpy torus in the low collision frequency limit.** Hastings, D.E. (Oak Ridge National Lab., TN). *Physics of Fluids;* **27**: No. 9, 2272-2286(Sep 1984). Contract W-7405-ENG-26.

The electron neoclassical transport coefficients are calculated in a bumpy torus for the low collisionality regime. The electron radial drift is calculated as a function of the plasma position, as well as the poloidal electric field, which is determined self-consistently. A bounce-averaged differential collisional operator is used and the results are compared to previous treatments using a BGK operator.

11963 **Radial structure of curvature-driven instabilities in a hot-electron plasma.** Spong, D.A.; Berk, H.L.; Van Dam, J.W. (Oak Ridge National Lab., TN). *Physics of Fluids;* **27**: No. 9, 2292-2307(Sep 1984). Contract W-7405-ENG-26.

A nonlocal analysis of curvature-driven instabilities for a hot-electron ring interacting with a warm background plasma has been made. Four different instability modes characteristic of hot-electron plasmas have been examined: the high-frequency hot-electron interchange (at frequencies larger than the ion-cyclotron frequency), the compressional Alfven instability, the interacting background pressure-driven interchange, and the conventional hot-electron interchange (at frequencies below the ion-cyclotron frequency). The decoupling condition between core and hot-electron plasmas has also been examined, and its influence on the background and hot-electron interchange stability boundaries has been studied. The assumed equilibrium plasma profiles and resulting radial mode structure differ somewhat from those used in previous local analytic estimates; however, when the analysis is calibrated to the appropriate effective radial wavelength of the nonlocal calculation, reasonable agreement is obtained. Comparison with recent experimental measurements indicates that certain of these modes may play a role in establishing operating boundaries for the ELMO Bumpy Torus-Scale (EBT-S) experiment. The calculations given here indicate the necessity of having core plasma outside the ring to prevent the destabilizing wave resonance of the precessional mode with a cold plasma.

11964 **Marfe: an edge plasma phenomenon.** Lipschultz, B.; LaBombard, B.; Marmar, E.S.; Pickrell, M.M.; Terry, J.L.; Watterson, R.; Wolfe, S.M. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). *Nuclear Fusion;* **24**: No. 8, 977-988(Aug 1984).

A tokamak edge phenomenon, dubbed the 'marfe' (for multifaceted asymmetric radiation from the edge), is described. This phenomenon, observed in medium- to high-density Alcator C discharges, is characterized by greatly increased radiation, density and density fluctuations, and decreased temperature in a relatively small volume at the inner major radius edge of the plasma. The marfe appears to be confined to minor radii greater than or of the order of that of the limiter. The affected region is typically above the midplane, extending poloidally for about 30 deg. and toroidally for 360 deg. The temperature and density of the core plasma are unaffected by the marfe. A simple transport model is used to show that the marfe is the manifestation of a thermal instability, with impurity radiation being the main energy loss mechanism out of the marfe volume. A density threshold nsub(m) for marfe onset is observed; nsub(m) is found to be an increasing function of plasma current and a decreasing function of intrinsic low-Z impurity levels. Detailed observations from spectroscopy, bolometry, Langmuir probe measurements, interferometry and CO_2 scattering are presented.

11965 **Measurement of chisub(e) in ISX-B beam-heated discharges by heat pulse propagation.** Bell, J.D.; Dunlap, J.L.; Pare, V.K.; Callen, J.D.; Howe, H.C.; Lazarus, E.A.; Murakami, M.; Thomas, C.E. (Oak Ridge National Lab., TN (USA)). *Nuclear Fusion;* **24**: No. 8, 997-1002(Aug 1984).

New measurements of the electron thermal diffusivity coefficient chisub(e) for beam-heated (0-1.6 MW) discharges in the Impurity Study Experiment (ISX-B) tokamak confirm the numerical values and trends, with beam power inferred earlier from power balance considerations, and thus support the conclusion that the confinement deterioration with increasing beam power is due to enhanced electron heat conduction losses.

11966 **Particle-confinement criteria for axisymmetric field-reversed magnetic configurations.** Hsiao, M.Y.; Miley, G.H. (Illinois Univ., Urbana (USA). Fusion Studies Lab.). *Nuclear Fusion;* **24**: No. 8, 1029-1038(Aug 1984).

Based on two constants of motion, H and Psub(theta), where H is the total energy of a particle and Psub(theta) is its canonical angular momentum, particle confinement criteria are derived which impose constraints on H and Psub(theta). With no electric field at the ends of field-reversed magnetic configurations, confinement criteria for closed-field and absolute confinements are obtained explicitly, including both lower and upper bounds of Psub(theta)/q, where q is the charge of the species considered, for a class of Hill's vortex field-reversed magnetic configurations. The commonly used criterion for the Hamiltonian, $H<-\omega_0$Psub(theta), where ω_0 is identical to qB_0/mc, is deduced from a more general form as a special case. In this special case, it is found necessary to impose a new criterion, $-B_0R^2sub(w)/2c<$Psub(theta)$/q<0$, where Rsub(w) is the wall radius and B_0 is the vacuum field, which reduces the confinement region in (H,Psub(theta)) space. With the presence of electric fields at the ends of field-reversed magnetic configurations, confinement criteria are obtained for two interesting cases. In addition to lower and upper bounds of H, both lower and upper bounds of Psub(theta)/q are found. For axially confined particles, the lower bound of Psub(theta)/q reduces the confinement region in (H,Psub(theta)) space and represents a new criterion. These results

can be applied to calculations for field-reversed mirrors and field-reversed theta pinches.

11967 **Coupling to the fast wave via a phased waveguide array.** Olson, L.; McWilliams, R.; Glanz, J.; Motley, R.W. (Princeton Univ., NJ (USA). Plasma Physics Lab.). *Nuclear Fusion;* **24**: No. 8, 1085-1087(Aug 1984).

Letter-to-the-editor.

A dielectric-loaded waveguide array has been used to launch fast waves into a plasma in which ωsub(pi)<ω<<ωsub(pe) approx.= ωsub(ce). The wave propagates when accessibility and cut-off requirements are satisfied. Reflection coefficients as low as 1% have been measured. Use of the fast wave for steady-state current drive is suggested.

11968 **Stability of an elongated axisymmetric mirror with an energetic axis-encircling ion component.** Seyler, C.E.; Krall, J.F.; Sparks, L.; Sudan, R.N. (Cornell Univ., Ithaca, NY (USA). Lab. of Plasma Studies). *Nuclear Fusion;* **24**: No. 8, 1013-1021(Aug 1984).

The equilibrium and stability of a long-thin axisymmetric magnetic mirror with a nearly axis-encircling energetic ion component is presented. A local sufficient condition valid for arbitrary azimuthal mode number (m) is derived and numerically evaluated. The results indicate that the ion beam component is highly stabilizing in regions where the beam density is increasing outwards and destabilizing where it is decreasing outwards. The results also show the existence of a persistent coupling of the beam particles to the magneto-hydrodynamic interchange mode for large m. This result disagrees with previous work which showed a decoupling of orbits and mode perturbations for large m. This disagreement is attributable to the special periodic nature of the nearly axis-encircling orbits in long and thin configurations and indicates that aperiodic or stochastic orbits whose gyrocentres have a minimum spread would be more effective in providing stabilization.

11969 **Finite-Larmor-radius modification of the Mercier criterion.** Connor, J.W.; Tang, W.M.; Allen, L. (Princeton Univ., NJ (USA). Plasma Physics Lab.). *Nuclear Fusion;* **24**: No. 8, 1023-1027(Aug 1984).

The finite-Larmor-radius modification of the Suydam criterion involves a competition between stabilizing finite-Larmor-radius effects and destabilizing curvature. In the case of the toroidal calculation, corresponding to the Mercier criterion, ballooning effects from regions of unfavourable curvature must be taken into account. In the case of a model equilibrium, valid near the magnetic axis, a complete solution is obtained. Results indicate that the amount of finite-Larmor-radius stabilization needed to overcome the effects of unfavourable average curvature increases as a function of the toroidal ballooning parameter.

11970 **Linear tearing mode stability for low-q cylindrical tokamaks.** Rosenblum, M. (INESCO, La Jolla, CA (USA)). *Journal of Plasma Physics;* **31**: 447-463(Jun 1984).

Detailed computational results are presented for the stability of linear tearing modes in low-q cylindrical tokamaks with various radial profiles. The stability properties of a widely used 'classical' profile are compared with those of a 'piecewise' profile. It is shown that the stability properties of low-q tokamak discharges show a sensitive dependence on small changes in the current density profile near the singular surface. While the 'classical' profile is stable for a large range of q_0, where q_0 is the value of the safety factor on the magnetic axis, a similar 'piecewise' profile is unstable for the same set of parameters.

11971 **Parametric decay of Langmuir waves in an electron beam-plasma system.** Willett, J.E.; Aktas, Y. (Missouri Univ., Columbia (USA). Dept. of Physics). *Journal of Plasma Physics;* **31**: 465-475(Jun 1984).

Backscattering of Langmuir waves from low-frequency electrostatic waves in a plasma traversed by an electron beam is studied. The analysis is based on the use of beam electron, plasma electron, and ion susceptibilities provided by kinetic theory. For the case of a warm electron beam, formulae are derived for the growth rate and threshold associated with resonant backscattering from an ion-acoustic wave modified by the presence of the beam. For the case of a cold electron beam, formulae are derived from the growth rates associated with resonant backscattering from a modified ion-acoustic wave and from a higher-frequency beam-plasma mode. A numerical study of the effects of an electron beam on these parametric instabilities is included.

11972 **Capillary discharge thermonuclear burner.** McCorkle, R.A. (International Business Machines Corp., Yorktown Heights, NY (USA)). *Nuovo Cimento [Sezione] B;* **77**: No. 1, 31-41(11 Sep 1983).

Transient behaviour of high-power discharges in small-diameter capillaries is a means for obtaining thermonuclear burn.

7002 Fusion Power Plant Technology

REFER ALSO TO CITATION(S) 70020011390, 11934, 11936, 11937, 11956

11973 **(CONF-841234—4) 60 GHz, 200 kW CW gyrotron with high output mode purity.** Jory, H.; Felch, K.; Bier, R.; Fox, L.; Huey, H.; Ives, L.; Lopez, N.; Manca, J.; Shively, J.; Spang, S. (Varian Associates, Inc., Palo Alto, CA (USA)). 1984. Contract AC05-84OR21400. 4p. NTIS, PC A02. File Number DE85005283.

From International electron devices meeting; San Francisco, CA, USA (10 Dec 1984).

For the first time, a Varian 60 GHz gyrotron, designed specifically to generate microwaves in a single output mode, has been operated at power levels up to 200 kW CW. High output mode purity is required for the efficient utilization of gyrotrons as high power microwave sources for electron cyclotron resonance heating (ECRH) in magnetic fusion plasmas. Using mode-specific directional couplers, measurements of the output mode content indicated that greater than 95% of the microwave output was in the desired TE_{02} mode, with only small percentages in the neighboring TE_{01} and TE_{03} circular electric modes. The pure mode CW design uses a 2.5-inch diameter collector. The collector has a magnetic field arrangement which capably avoids excessive heating by distributing the 640 kW CW beam over a sufficient collector area. With pure mode operation, window temperatures are 10°C to 15°C higher than with mixed mode operation.

11974 **(CONF-841246—8) Special purpose materials for fusion application.** Scott, J.L.; Clinard, F.W. Jr.; Wiffen, F.W. (Oak Ridge National Lab., TN (USA); Los Alamos National Lab., NM (USA)). 1984. Contract AC05-84OR21400. 27p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85005346.

From 1. international conference on fusion reactor materials; Tokyo, Japan (3 Dec 1984).

Originally in 1978 the Special Purpose Materials Task Group was concerned with tritium breeding materials, coolants, tritium barriers, graphite and silicon carbide, ceramics, heat-sink materials, and magnet components. Since then several other task groups have been created, so now the category includes only materials for superconducting magnets and ceramics. For the former application copper-stabilized Nb_3Sn (Ti) insulated with polyimides will meet the general requirements, so that testing of prototype components is the priority task. Ceramics are required for several critical components of fusion reactors either as dielectrics or as a structural material. Components near the first wall will receive exposures of 5 to 20 MW.year/m². Other ceramic applications are well behind the first wall, with lower damage levels. Most insulators operate near room temperature, but ceramic blanket structures may operate up to 1000°C. Because of a meager data base, one cannot identify optimum ceramics for structural application; but $MgAl_2O_4$ is an attractive dielectric material.

11975 **(CONF-841246—10) Materials engineering for TFCX.** Wiffen, F.W. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 27p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85005363.

From 1. international conference on fusion reactor materials; Tokyo, Japan (3 Dec 1984).

Diagrams are given showing the TFCX components such as the shield sector module, toroidal field coil, and shielding requirements. (MOW)

11976 **(DOE/ET/51013—122) Confinement results from pellet fueled discharges in Alcator C.** Greenwald, M.; Gwinn, D.; Milora, S.; Parker, J.; Parker, R.; Wolfe, S.; Besen, M.; Camacho, F.; Fairfax, S.; Fiore, C. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). May 1984. Contract AC02-78ET51013. 21p. (PFC/CP—84-12; CONF-840311—17). NTIS, PC A02/MF A01; GPO Dep. File Number DE85004914.

From 4. international symposium on heating in toroidal plasmas; Rome, Italy (21 Mar 1984).

Results are presented from studies of pellet fueling in the Alcator C tokamak. Hydrogen and deuterium pellets, injected at high velocity, penetrate deep into the plasma, fuel the discharge core, and produce peaked high density discharges. Energy confinement in pellet fueled ohmically heated plasmas was observed to increase over that in similar discharges fueled only by gas puffing.

11977 **(LBL—18397) Diagnostics for the NBETF actively cooled beamdump.** Theil, E.; Jacobson, V. (Lawrence Berkeley Lab., CA (USA)). Sep 1984. Contract AC03-76SF00098. 11p. (CONF-840915—10). NTIS, PC A02. File Number DE85004128.

From 13. symposium on fusion technology; Varese, Italy (24 Sep 1984).

Lawrence Berkeley Laboratory's Neutral Beam Engineering Test Facility is currently testing multi-megawatt beams with pulse durations of up to 30 seconds. For this purpose, an actively cooled beam dump composed of heat-absorbing panels tht dissipate the beam energy via high speed water flow has been installed and tested. The panels are mounted in a complex assembly necessary to accommodate the variety of ion sources to be tested. The beam dump required new diagnostics of two kinds: beam diagnostics that provide graphic and quantitative information about the beam, as inferred from energy transferred to the water, and panel diagnostics that provide graphic and quantitative information about the beam dump itself. In this paper we describe our response to these requirements, including new algorithms for beam profiles, and we compare this work to our earlier results for inertial beam dumps. Principal differences are that the power densities on the water-cooled panels can be only indirectly inferred from measurements of the transferred beam energy, and that the acquisition and preparation of raw data is much more complex.

11978 **(ORNL/TM—9110) ELMO Bumpy Square.** (Oak Ridge National Lab., TN (USA)). Oct 1984. Contract AC05-84OR21400. 250p. NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE85000664.

Separate abstracts were prepared for each of the 9 included papers. (MOW)

11979 (ORNL/TM—9110, pp 39-58) **Ripple effects in ELMO Bumpy Square.** Uckan, N.A. Oct 1984. NTIS, PC A11/MF A01. File Number DE85000664.

In ELMO Bumpy Square.

The allowable magnitudes of the magnetic field ripple in the high-field toroidal solenoids (corners) of the ELMO Bumpy Square (EBS) are calculated. The enhanced transport coefficients associated with the ripple-induced drifts are compared with the ELMO Bumpy Torus (EBT) neoclassical diffusion coefficients.

11980 (ORNL/TM—9110, pp 59-72) **Field error calculations in an ELMO Bumpy Square (EBS).** Uckan, N.A.; Lee, D.K.; Uckan, T. Oct 1984. NTIS, PC A11/MF A01. File Number DE85000664.

In ELMO Bumpy Square.

A closed field line device, such as an ELMO Bumpy Torus (EBT) or an ELMO Bumpy Square (EBS), is very sensitive to small perturbations in the magnetic field. Numerical calculations of field errors due to single-coil misalignments indicate that the field line closure is most sensitive to angular misalignments of the coils in both EBT and EBS. Errors in absolute spatial positions are found to have very small effects, provided there is no corresponding angular misalignment. Statistical analysis of errors from N coils (where N = N/sub s/ + N/sub c/, with N/sub s/ the total number of coils in straight sections and N/sub c/ the total number of coils in high-field curved corner sections), assuming the errors in all N coil alignments are randomly distributed in a Gaussian fashion, is found to be in reasonable agreement with the numerical calculations. A specific example for an EBS configuration is given. Each side of this EBS configuration consists of a linear array of five EBT-S coils, and the corners are formed by 90° sections having eight half-size (one-half number of turns) EBT-S coils with a ratio of currents I/sub corner//I/sub side/ ≅ 1.2 to 1.4. Calculations indicate that a misalignment of 1 cm in one coil yields an error $\delta B/B < 10^{-5}$, whereas a misalignment of 1° in one coil orientation results in an error $\delta B/B \sim 10^{-4}$. Corresponding errors in EBT-S are $\delta B/B < 10^{-10}$ for 1 cm misalignment of one coil and $\delta B/B \sim 10^{-4}$ for 1° misalignment of one coil orientation.

11981 (ORNL/TM—9110, pp 209-220) **Conceptual design for ELMO Bumpy Square.** Uckan, N.A.; Bryan, W.E.; McManamy, T.J.; Thompson, P.B.; Wright, W.L.; Berry, L.A. Oct 1984. NTIS, PC A11/MF A01. File Number DE85000664.

In ELMO Bumpy Square.

Conceptual design of the ELMO Bumpy Square (EBS), involving modification and reconfiguration of the present ELMO Bumpy Torus (EBT-I/S) experiment, has been completed. The detailed conceptual design report will appear elsewhere. In this section, for completeness, we include some of the engineering drawings and equipment specifications for reconfiguring the EBT-I/S device from a torus into a square. The following discussion assumes that the EBS project will be realized despite recent US Department of Energy (DOE) program decisions due to budgetary constraints.

11982 (ORNL/TM—9110, pp 221-245) **Reactor assessments of advanced bumpy torus configurations.** Uckan, N.A.; Owen, L.W.; Spong, D.A.; Miller, R.L.; Ard, W.B.; Pipkins, J.F.; Schmitt, R.J. (Oak Ridge National Lab., TN; Applied Microwave Plasma Concepts, Inc., Encinitas, CA; McDonnell Douglas Astronautics Co., St. Louis, MO). Oct 1984. NTIS, PC A11/MF A01. File Number DE85000664.

In ELMO Bumpy Square.

Recently, several innovative approaches were introduced for enhancing the performance of the basic ELMO Bumpy Torus (EBT) concept and for improving its reactor potential. These include planar racetrack and square geometries, Andreoletti coil systems, and bumpy torus-stellarator hybrids (which include the twisted racetrack and helical axis stallarator-snakey torus). Preliminary evaluations of reactor implications of each approach have been carried out based on magnetics (vacuum) calculations, transport and scaling relationships, and stability properties deduced from provisional configurations that implement the approach but are not necessarily optimized. Further optimization is needed in all cases to evaluate the full potential of each approach.

11983 **(UCID—20141) Tritium permeation and recovery for the helium-cooled molten salt fusion breeder.** Sherwood, A.E. (Lawrence Livermore National Lab., CA (USA)). Sep 1984. Contract W-7405-ENG-48. 57p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85005304.

Design concepts are presented to control tritium permeation from a molten salt/helium fusion breeder reactor. This study assumes tritium to be a gas dissolved in molten salt, with TF formation suppressed. Tritium permeates readily through the hot steel tubes of the reactor and steam generator and will leak into the steam system at the rate of about one gram per day in the absence of special permeation barriers, assuming that 1% of the helium coolant flow rate is processed for tritium recovery at 90% efficiency per pass. The proposed permeation barrier for the reactor tubes is a 10 μm layer of tungsten which, in principle, will reduce tritium blanket permeation by a factor of about 300 below the bare-steel rate. A research and development effort is needed to prove feasibility or to develop alternative barriers. A 1 mm aluminum sleeve is proposed to suppress permeation through the steam generator tubes. This gives a calculated reduction factor of more than 500 relative to bare steel, including a factor of 30 due to an assumed oxide layer. The permeation equations are developed in detail for a multi-

layer tube wall including a frozen salt layer and with two fluid boundary-layer resistances. Conditions are discussed for which Sievert's or Henry's Law materials become flux limiters. An analytical model is developed to establish the tritium split between wall permeation and reactor-tube flow.

11984 **Laser-beam cleaning in a plasma compressor.** Marchand, R.; Capjack, C.E.; James, C.R. (Department of Electrical Engineering, University of Alberta, Edmonton, Alberta, Canada T6G 2E7). *Journal of Applied Physics;* **57**: No. 3, 732-739(1 Feb 1985).

The temporal compression of a KrF laser pulse in a plasma cell via Raman backscattering is a promising technique for obtaining pulse widths of relevance to laser-driven fusion. It is shown that this technique can also serve as an effective means for cleaning the spatial modulations in a pump beam. When a spatially incoherent pump is compressed by an initially Gaussian Stokes pulse, the spatial nonuniformities in the pump are averaged out to yield a smooth, nearly Gaussian Stokes pulse. Strong modulations in the pump lead to less overlap with the Stokes pulse, thus indicating a compromise between compression efficiency and the amount of incoherency that can be tolerated in the input pump. It is argued, however, that for compressors operated in the saturated gain limit, with sufficiently long Stokes pulses, considerable beam cleaning can be achieved with little loss of efficiency.

11985 **Fourier method for three-dimensional partial differential equations in periodic geometry. Application: HELIAC.** Shestakov, A.I.; Mirin, A.A. (National Magnetic Fusion Energy Computer Center, Lawrence Livermore National Laboratory, Livermore, California 94550). *Journal of Computational Physics;* **56**: No. 3, 469-529(Dec 1984). Contract W-7405-ENG-48.

A numerical method based on Fourier expansions and finite differences is presented. The method is demonstrated by solving a scalar, three-dimensional elliptic equation arising in MFE research, but has applicability to a wider class of problems. The scheme solves equations whose solutions are expected to be periodic in one or more of the independent variables.

11986 **Equilibrium and non-equilibrium microfireball behaviour in light-ion fusion systems.** Uesaka, M.; Peterson, R.R.; Moses, G.A. (Wisconsin Univ., Madison (USA). Dept. of Nuclear Engineering). *Nuclear Fusion;* **24**: No. 9, 1137-1147(Sep 1984).

Light-ion fusion reactors and high-yield target testing facilities will have a gas-filled reaction vessel. The target microexplosion will create a microfireball in this gas. The behaviour of this microfireball as it propagates and reflects from the reaction vessel wall is critical to the design of the vessel. The type of gas and the modelling assumptions used for analysis can significantly affect the prediction of this behaviour. The effects of two-temperature and multifrequency radiative transfer models are investigated for nitrogen and argon gases. The isothermal sphere model and the target X-ray attenuation model for microfireball creation are compared. The computational results are related to the analytic strong-shock theory.

11987 **Development of a differential equation for the ambipolar electric field in a bumpy torus in the low collision frequency limit.** Hastings, D.E. (Oak Ridge National Lab., TN). *Physics of Fluids;* **27**: No. 9, 2372-2374(Sep 1984). Contract AC05-84OR21400.

In a bumpy torus the radial electric field is determined by the constraint of ambipolarity. If both species are dominated by nonresonant diffusion, then the ambipolarity relationship as it is usually formulated is algebraic in the electric field. The solutions of this algebraic equation may have a discontinuous first derivative of the electric field. The unphysical situation arises from the neglect of the finite orbit deviation from the pressure surface. If the fluxes are calculated to higher order in the inverse aspect ratio, a second-order differential equation for the electric field is obtained that will give a continuous first derivative for the electric field.

11988 **Fusion reactor materials. Pt. A. Proceedings.** Whitley, J.B. (Sandia National Labs., Albuquerque, NM (USA)); Wilson, K.L. (Sandia National Labs., Livermore, CA (USA)); Clinard, F.W. Jr. (Los Alamos National Lab., NM (USA)). Amsterdam ,Netherlands.; North Holland (May 1984). 868p. (CONF-840942—).

From 16. ICHMT symposium on heat and mass transfer in fixed and fluidized beds; Dubrovnik, Yugoslavia (3 Sep 1984).

CODEN: JNUMA.

These papers have been presented on the 3sup(rd) Topical Meeting on Fusion Reactor Materials, held in Albuquerque, New Mexico, on September 19-22, 1983. All proceedings to this meeting have been part of one of the following categories of interest in the field of Materials Science related to Fusion Reactor applications: 1) Engineering materials + design, 2) Ferrous structural materials, 3) Radiation effects/mechanical properties, 4) Austenitic stainless steels, 5) Helium-induced phenomena, 6) Microstructure/radiation effects, 7) Advanced Materials.

11989 **Future technology requirements for magnetic fusion--An evaluation based on conceptual design studies.** Stacey, W.M.; Baker, C.C.; Conn, R.W.; Krakowski, R.A.; Steiner, D.; Thomassen, K.I. (Georgia Institute of Technology School of Nuclear Engineering, Atlanta, Georgia 30332). *Nuclear Technology/Fusion;* **5**: No. 3, 266-290(May 1984).

The future technology requirements for magnetic fusion have been identified from an assessment of the conceptual design studies that have been performed. A summary of worldwide conceptual design effort is presented. The relative maturity of the various confinement concepts and the intensity and continuity of the design efforts are taken into account in identifying future technology requirements. A major conclusion of this study is that there is a high degree of commonality among the technology requirements identified for the various confinement concepts.

11990 **The materials impact on fusion reactor safety.** Piet, S.J.; Kazimi, M.S.; Lidsky, L.M. (Massachusetts Institute of Technology, Department of Nuclear Engineering Cambridge, Massachusetts 02139). *Nuclear Technology/Fusion;* **5**: No. 3, 382-392(May 1984).

Seven potential safety concerns for deuteriumtritium fusion reactors were examined and the influence of blanket material choice determined. This influence was quantified in terms of relative consequence indices (RCIs) according to prescribed consequence criteria. Selected combinations of structural material (Type 316 stainless steel, HT-9, vanadium alloy, or TZM), primary coolant (pressurized water, helium, lithium, or flibe), and tritium breeder ($LiAlO_2$, lithium, or $Li_{17}Pb_{83}$) were examined. The analyses and indices were structured to focus on the specific material properties that influence the results, which allows for comparison of materials not included in the present study.

11991 **System studies for a quasi-steady-state Advanced Physics Tokamak/.** Reid, R.L.; Peng, Y.K. *Nuclear Technology/Fusion;* **5**: No. 3, 356-373(May 1984).

Parametric studies were conducted using the Fusion Engineering Design Center Tokamak Systems Code to investigate the impact of variation in physics parameters and technology limits on the performance and cost of a low q/psi/, high beta, quasi-steady-state tokamak for the purpose of fusion engineering experimentation. The features and characteristics chosen from each study were embodied into a single Advanced Physics Tokamak design for which a selfconsistent set of parameters was generated and a value of capital cost was estimated.

11992 **Tokamak fusion reactors with less than full tritium breeding.** Evans, K.; Gilligan, J.G.; Jung, J. (Argonne National Laboratory, 9700 South Cass Avenue, Argonne, Illinois 60439). *Nuclear Technology/Fusion;* **5**: No. 3, 311-325(May 1984).

A study of commercial tokamak fusion reactors with tritium concentrations and tritium breeding ratios ranging from full deuterium-tritium operation to operation with no tritium breeding is presented. The design basis for these reactors is similar to those of

STARFIRE and WILDCAT. Optimum operating temperatures, sizes, toroidal field strengths, and blanket/ shield configurations are determined for a sequence of reactor designs spanning the range of tritium breeding, each having the same value of beta, thermal power, and first-wall heat load. Additional reactor parameters, tritium inventories and throughputs, and detailed costs are calculated for each reactor design. The disadvantages, advantages, implications, and ramifications of tritium-depleted operation are presented and discussed.

11993 **Lower activation materials and magnetic fusion reactors.** Conn, R.W.; Bloom, E.E.; Davis, J.W.; Gold, R.E.; Little, R.; Schultz, K.R.; Smith, D.L.; Wiffen, F.W. (University of California, Los Angeles School of Engineering & Applied Science Los Angeles, California 90024). *Nuclear Technology/Fusion;* **5**: No. 3, 291-310(May 1984).

Radioactivity in fusion reactors can be effectively controlled by materials selection. The detailed relationship between the use of a material for construction of a magnetic fusion reactor and the material's characteristics important to waste disposal, safety, and system maintainability has been studied. The quantitative levels of radioactivation are presented for many materials and alloys, including the role of impurities, and for various design alternatives. A major outcome has been the development of quantitative definitions to characterize materials based on their radioactivation properties. Another key result is a four-level classification scheme to categorize fusion reactors based on quantitative criteria for waste management, system maintenance, and safety. A recommended minimum goal for fusion reactor development is a reference reactor that (a) meets the requirements for Class C shallow land burial of waste materials, (b) permits limited hands-on maintenance outside the magnet's shield within 2 days of a shutdown, and (c) meets all requirements for engineered safety. The achievement of a fusion reactor with at least the characteristics of the reference reactor is a realistic goal. Therefore, in making design choices or in developing particular materials or alloys for fusion reactor applications, consideration must be given to both the activation characteristics of a material and its engineering practicality for a given application.

11994 **An analysis of bremsstrahlung energy deposition in magnetic fusion first wall materials.** Carroll, M.C.; Gilligan, J.G. (University of Illinois at Urbana-Champaign Nuclear Engineering Program, Urbana, Illinois 61801). *Nuclear Technology/Fusion;* **5**: No. 3, 334-349(May 1984).

A model for predicting bremsstrahlung energy deposition in first-wall materials and the effect of this energy deposition on wall temperature distributions is proposed. In this model the bremsstrahlung energy spectrum is divided into a finite number of discrete energy groups, each with an overall power fraction and average wavelength. The volumetric heating effects of each of these individual groups are superimposed to obtain overall temperature distributions in first-wall configurations using rectangular and cylindrical coordinates. The proposed multigroup model is then applied to several first-wall designs and compared with existing models, notably the "surface-heating" model, which utilizes the assumption that the bremsstrahlung energy is deposited on the wall surface. It is concluded that in many designs involving advanced fuels or low-Z first-wall materials the surface-heating model overpredicts wall temperatures near the plasma side, and the multigroup model may be necessary for accurate temperature calculation.

11995 **New challenges in fusion research for the materials scientist.** Kulcinski, G.L. (Wisconsin Univ., Madison (USA)). pp 131-139 of Dimensional stability and mechanical behaviour of irradiated metals and alloys. V. 2. Proceedings of the conference organized by the British Nuclear Energy Society, Brighton, 11-13 April 1983. London ,UK.; British Nuclear Energy Society (1984). (CONF-830418—).

From International conference on dimensional stability and mechanical behavior of irradiated metals and alloys; Brighton, UK (11 Apr 1983).

Recent progress in fusion research has led to several unique materials requirements. The use of room temperature magnets to generate magnetic fields of 20 T or more at 1 to 2 MW/m^2 neutron wall loadings in Tandem Mirror reactors must be demonstrated. Reactor and current experimental device designs have attempted to solve the impurity control problem by placing particle collector plates near the plasma. These plates must handle heat fluxes of several hundred W/cm^2 while at the same time withstand high neutron fluxes and disruptions. The recent trend to use RF power for heating and confinement purposes in tokamaks and mirrors has raised the question of successful operation of antenna or wave guides that face the plasma and its high neutron flux. Finally, recent progress in breeding/cooling materials such as Pb-Li alloys, plus demonstrations of enhanced radiation damage resistance, have opened up the fusion field for ferritic steels. Questions about magnetic field perturbations and magnetic forces on the structure have been addressed and do not appear to be serious in mirror reactors.

11996 **Computer control and data acquisition for neutral beam injectors.** Glad, A.S. (General Atomic Co., San Diego, CA (USA)). pp 1411-1419 of Fusion technology 1982. Proceedings of the 12. symposium held in Juelich, 13-17 September 1982. 2 v. Oxford, England; Pergamon Press (1983). (CONF-820948—). Contract AT03-76ET51011.

From 12. symposium on fusion technology; Juelich, F.R. Germany (13 Sep 1982).

Price Pound 125.00.

A description is given of computer control and data acquisition systems for neutral beam injectors.

11997 **Inertial confinement fusion concepts for advanced fuels.** Miley, G.; Stubbins, J.; Ragheb, M.; Choi, C. (Illinois Univ., Urbana (USA). Fusion Studies Lab.); Magelssen, G. (Los Alamos National Lab., NM (USA)); Martin, R. (Argonne National Lab., IL (USA)). pp v.2 p.869-874 of Fusion technology 1982. Proceedings of the 12. symposium held in Juelich, 13-17 September 1982. 2 v. Oxford ,UK.; Pergamon Press (1983). (CONF-820948—).

From 12. symposium on fusion technology; Juelich, F.R. Germany (13 Sep 1982).

Price Pound125.00.

The AFLINT concept for a deuterium burning inertial confinement target is described. This target eliminates the need to breed tritium in the chamber blanket and reduces the fraction of energy carried by neutrons. Both features require a new approach to ICF chamber design and a possible scenario is briefly noted.

11998 **Inertial fusion reactor studies at Lawrence Livermore National Laoratory.** Monsler, M.J.; Meier, W.R. (Lawrence Livermore National Lab., CA (USA)). pp v.2 p.881-888 of Fusion technology 1982. proceedings of the 12. symposium held in Juelich, 13-17 September 1982. 2 v. Oxford ,UK.; Pergamon Press (1983). (CONF-820948—).

From 12. symposium on fusion technology; Juelich, F.R. Germany (13 Sep 1982).

Price Pound125.00.

Results are presented of reactor studies for inertial fusion energy production. Design studies of liquid-metal wall chambers have led to reactors that are remarkably simple in design, and that promise long life and low cost. Variants of the same basic design, called HYLIFE, can be used for electricity production, as a fissile fuel factory, a dedicated tritium breeder, or hybrids of each.

11999 **Technology development facility (TDF).** Doggett, J.N. (Lawrence Livermore National Lab., CA (USA)). pp v.2 p.753-757 of Fusion technology 1982. Proceedings of the 12. symposium held in Juelich, 13-17 September 1982. 2 v. Oxford ,UK.; Pergamon Press (1983). (CONF-820948—).

From 12. symposium on fusion technology; Juelich, F.R. Germany (13 Sep 1982).

Price Pound125.00.

A study has been made of small, driven, magnetic-mirror-based fusion reactors for the Technology Development Facility (TDF), that will test fusion reactor materials, components, and subsystems. Magnetic mirror systems are particularly interesting for this application because of their inherent steady-state operation, potentially high neutron wall loading, and relatively small size.

12000 **Prospects for low activity aluminium structures.** Powell, J.R.; Fillo, J.A. (Brookhaven National Lab., Upton, NY (USA)). pp v.2 p.809-814 of Fusion technology 1982. Proceedings of the 12. symposium held in Juelich, 13-17 September 1982. 2 v. Oxford ,UK.; Pergamon Press (1983). (CONF-820948—).

From 12. symposium on fusion technology; Juelich, F.R. Germany (13 Sep 1982).

Price Pound125.00.

High-purity, low-activity powder metallurgy Al alloys can be developed for use in a fusion reactor at 300deg to 400deg C using He as a heat transfer medium. Hot water as a coolant may limit Al to 200deg C. Based on the dual- or two-temperature design approach, commercial fusion reactor blanket designs are feasible. Aluminium appears well suited for experimental fusion reactors operating at wall temperatures below 200deg C.

12001 **FED reactor engineering features.** Sager, P.H.; Brown, T.G.; Fuller, G.M.; Smith, G.E. (Oak Ridge National Lab., TN (USA)). pp v.2 p.901-907 of Fusion technology 1982. Proceedings of the 12. symposium held in Juelich, 13-17 September 1982. 2 v. Oxford ,UK.; Pergamon Press (1983). (CONF-820948—). Contract W-7405-ENG-26.

From 12. symposium on fusion technology; Juelich, F.R. Germany (13 Sep 1982).

Price Pound125.00.

Details are given of the Fusion Engineering Device (FED) baseline design incorporating a number of features which were selected to enhance its maintainability, as well as limit cost and achieve reliable operation.

12002 **Pellet fuelling development at Oak Ridge National Laboratory.** Foster, C.A.; Milora, S.L.; Schuresko, D.D.; Combs, S.K.; Lunsford, RV. (Oak Ridge National Lab., TN (USA)). pp v.2 p.1513-1518 of Fusion technology 1982. Proceedings of the 12. symposium held in Juelich, 13-17 September 1982. 2 v. Oxford ,UK.; Pergamon Press (1983). (CONF-820948—).

From 12. symposium on fusion technology; Juelich, F.R. Germany (13 Sep 1982).

Price Pound125.00.

Injecting high speed frozen pellets of D_2, T_2 has been proposed as a means of continuously fueling a tokamak reactor. Deuterium and tritium pellets 4 mm in diameter, injected at a speed of 2 km/s and a rate of 20 pellets/s, are shown to directly fuel 60% of the plasma volume, as opposed to 5% for gas injection. A pellet injector development program with the goals of developing D_2, T_2 pellet fuel injectors capable of reliable repetitive fueling of reactors and of continued experimentation on contemporary plasma devices is reported. The development has focused primarily on two types of injectors that show promise. One of these injectors is the centrifuge-type injector, which accelerates pellets in a high speed rotating track. The other is the gas or pneumatic gun, which accelerates pellets in a gun barrel using compressed helium or H_2 gas.

99 GENERAL AND MISCELLANEOUS

9901 Management

12003 **(DOE/MA—0142/1) Department of Energy annual procurement and federal assistance report, FY 1984.** (USDOE Assistant Secretary for Management and Administration, Washington, DC. Directorate of Procurement and Assistance Management). Jan 1985. 34p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85006181.

DOE procurement and federal assistance obligations in FY 1984 were $14,817,437,526, an increase of 6.2% from FY 1983. Obligations for management and operating contractors totalled $9,675,993,308; an 11.2% increase over FY 1983. The number of active procurement awards over $25,000 (excluding management and operating contracts) on September 30, 1984, was 3649, with a total award value of $37,280,349,171. This compares with 4132 active awards with a value of $40,951,611,179 on September 30, 1983. The number and award value of federal assistance instruments active on September 30, 1984, was 5414 and $2,919,968,302. On September 30, 1983, there were 5522 active awards with a value of $2,592,283,000. Subcontract awards were worth $4,362,191,000 in FY 1984, of which $2,082,417,000 or 47.7% went to small business firms. In FY 1983, subcontracts worth $3,720,558,000 were awarded, of which $1,741,416,000 (46.8%) were awarded to small businesses. The Department funded 571 unsolicited proposals with a total value of $135 million in FY 1984. During the previous year, 465 unsolicited proposals were funded with a total award value of $91 million.

12004 **(K/D—5313) Schedule planning for construction projects.** Shunk, W.A. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 1982. Contract AC05-84OT21400. 4p. (CONF-820615—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004048.

From 26. American Association of Cost Engineers annual meeting; Houston, TX, USA (27 Jun 1982).

Operating contractors of government-owned facilities manage construction projects having a maximum value of $1,000,000. Successful execution is dependent upon pragmatic scheduling. Such scheduling requires that all activities (both engineering and non-engineering) be integrated into a compatible sequence of events with adequate time allowed for each event. To develop realistic schedules, project event standards and program measures of performance have been established.

12005 **(UCRL—52000-84-12) Energy and Technology Review.** (Lawrence Livermore National Lab., CA (USA)). Dec 1984. Contract W-7405-ENG-48. 36p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85005541.

This issue contains articles on planning of future LLNL directions, mortality studies of LLNL employees, and initiation studies of TATB-based high explosives. Abstracts were prepared for individual items. (GHT)

12006 (UCRL—52000-84-12, pp 1-8) **Charting our course.** Dec 1984. NTIS, PC A03/MF A01. File Number DE85005541.

In Energy and Technology Review.

In a two-year study, a Long-Range Planning Committee composed of scientists and engineers drawn from programs and disciplines at the Laboratory has examined possible new programs appropriate for the Laboratory and has charted the likely directions of programmatic change. The Committee recommends, among other things, continued high-priority work on survivable strategic offensive and defensive weapon systems, procurement of a second Nova laser target chamber as a relatively inexpensive way to nearly double research time on the laser, and intensive work on the special codes, languages, and computer architectures required to help future supercomputers achieve their potential high performance.

9902 Mathematics And Computers

REFER ALSO TO CITATION(S) 99020011479, 11899, 11902, 11942

12007 **(AD-A—146786/9/XAB) Future database machine architectures.** Hsiao, D.K. (Naval Postgraduate School, Monterey, CA (USA)). Sep 1984. 14p. (NPS—52-84-014). NTIS, PC A02/MF A01.

There are many software database management systems available on many general-purpose computers ranging from micros to super-mainframes. Database machines as backend computers can offload the database management work from the mainframe so that we can retain the same mainframe longer. However, the database backend must also demonstrate lower cost, higher performance, and newer functionality. Some of the fundamental architecture issues in the design of high-performance and great-capacity database machines are addressed. Solutions towards resolving these design issues are articulated. This article is written for the New York University's Symposium in New Directions of Database Systems on the basis of a lecture given at Microelectronic and Computer Technology, Inc.

12008 **(BNL—35551) Role of optical disk at computing centers.** Peskin, A.M. (Brookhaven National Lab., Upton, NY (USA)). 1984. Contract AC02-76CH00016. 7p. (CONF-850137—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85005124.

From International Society for Optical Engineering meeting; Los Angeles, CA, USA (21 Jan 1985).

Mass storage plays an increasingly important part in the changing role of the traditional open-shop computing center precipitation by the trend toward decentralization. A large number of mass storage applications are of the write-once type, for which the emerging optical disk technology is well suited. Some of the broad application areas are experiment data capture, shared reference data bases, program and documentation libraries, and medical studies requiring individual patient data. The utility of currently available optical disk products is being investigated for these applications for a variety of computing environments including those of IBM/sup tm/, DEC-VAX/sup tm/, and UNIX/sup tm/ products.

12009 **(CONF-841007—48) CHIL - a comprehensive histogramming language.** Milner, W.T.; Biggerstaff, J.A. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005356.

From Nuclear science symposium; Orlando, FL, USA (31 Oct 1984).

A high level language, CHIL, has been developed for use in processing event-by-event experimental data at the Holifield Heavy Ion Research Facility (HHIRF) using PERKIN-ELMER 3230 computers. CHIL has been fully integrated into all software which supports on-line and off-line histogramming and off-line preprocessing. CHIL supports simple gates, free-form-gates (2-D regions of arbitrary shape), condition test and branch statements, bit-tests, loops, calls to up to three user supplied subroutines and histogram generating statements. Any combination of 1, 2, 3 or 4-D histograms (32 megachannels max) may be recorded at 16 or 32 bits/channel. User routines may intercept the data being processed and modify it as desired. The CPU-intensive part of the processing utilizes microcoded routines which enhance performance by about a factor of two.

12010 **(DOE/ER/13122—1) Research work in the state-of-the-art in computer graphics. Progress report, August 1, 1983-June 31, 1984.** (George Washington Univ., Washington, DC (USA)). 1984. Contract AS05-83ER13122. 9p. NTIS, PC A02. File Number DE85004869.

Our current research work began with a broad evaluation of the state-of-the-art in computer graphics. We attempted to identify areas in which current practice was inadequate, what future requirements in graphics will be, expected developments in hardware, and other generally desirable features. We examined the ACM/SIGGRAPH Core and the ISO/GKS graphics standards, and determined that while they were adequate for current systems, they both had inherent design limitations that made them unsuitable for high-performance applications, for future requirements, and for programming ease and efficiency. We therefore decided to develop a new conceptual model for all of computer graphics, incorporating such advanced features as support for multi-dimensional spatial modeling and user-interface management. We felt it necessary to design a comprehensive model because many of the problems with current systems are a consequence of the poorly-coordinated design of their different parts. We also examined the subroutine package implementation and concluded that it was an inadequate vehicle for the powerful features we proposed. We therefore decided to implement the new conceptual model in a graphics programming language that would provide the benefits of compile-time error-checking, a more natural syntax, graphical datatypes, data abstraction, and language extensibility.

12011 **(EGG-IS—6494(1-85)) INEL User Network Exchange. Volume 1-85, Jan./Feb. 1985.** Williams, T.L. (ed.). (EG and G Idaho, Inc., Idaho Falls (USA)). Jan 1985. Contract AC07-76ID01570. 22p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85006108.

This newsletter, of interest to users of the INEL network, contains items of general interest, equipment modifications, business systems descriptions, and software products notes. (GHT)

12012 **(EGG-M—25484) Contribution of instrumentation and control software to system reliability.** Fryer, M.O. (EG and G Idaho, Inc., Idaho Falls (USA)). 1984. Contract AC07-76ID01570. 7p. (CONF-841122—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004693.

From Symposium on new technologies in nuclear power plant instrumentation and control; Washington, DC, USA (28 Nov 1984).

A new method of reliability assessment of combined software/hardware systems is presented. The method is based on a procedure called fault tree analysis which determines how component failures can contribute to system failure. Fault tree analysis is a well developed method for reliability assessment of hardware systems and produces quantitative estimates of failure probability based on component failure rates. It is shown how software control logic can be mapped into a fault tree that depicts both software and hardware contributions to system failure.

12013 **(LA—10255-T) Hardware description languages for systolic architectures.** Lewis, P.S. (Los Alamos National Lab., NM (USA)). Oct 1984. Contract W-7405-ENG-36. 143p. NTIS, PC A07/MF A01; GPO Dep. File Number DE85005318.

Thesis.

Systolic principles can be used to construct special purpose computer systems that achieve high throughput by exploiting algorithmic properties. These principles of regularity, localized communications, and parallel/pipelined execution nicely match the capabilities of integrated circuit technology. Hence, systolic arrays are an attractive method for building high-speed special-purpose hardware to rapidly solve sophisticated problems. However, the use of special-purpose hardware limits the applications base, making fixed costs such as those associated with system design much more critical. Although design costs are in part reduced by the very nature of systolic systems, further reduction can result from the use of automated design and descriptive tools. The design process stretches from the conception of the algorithm and its mapping onto an architecture down to the electronic implementation. In general, a good set of design tools allows the designer to describe, test, and trade off only those factors that are important at that particular point in the design process. A principle requirement in automating the design process is a formal notational mechanism that is capable of providing complete and unambiguous descriptions of the concepts being explored. This notational mechanism then provides a common basis for comparisons between alternate methods and an input mechanism to automated design tools. This thesis identifies the notational features that are necessary for the description of highly parallel, regular architectures such as systolic arrays. A set of language criteria is developed. A number of the more popular HDLs are evaluated using these criteria and their shortcomings noted. 65 references.

12014 **(LA-UR—76-2656) Impact of scalar performance on vector and parallel processors.** Rudsinski, L.E.; Worlton, W.J. (Los Alamos Scientific Lab., NM (USA)). 1976. Contract W-7405-ENG-36. 7p. NTIS, PC A02. File Number DE85004805.

The large scientific programs that require the computational power of a vector or parallel computer consume many hours of computer time for their completion. It is estimated that about 15 percent of this computational work is done in scalar mode, and the scalar performance can therefore be a critical component in the overall performance of a vector or parallel processor. Using heuristic models for both vector and parallel performance, this paper analyzes the overall performance of a supercomputer as a function of both scalar performance and the fraction of results generated in vector or parallel mode.

12015 **(LBL-PUB—3034-Rev.) Introduction to CHART: a graphic analysis and display system. Revision.** Herbig, J.; Sventek, V. (Lawrence Berkeley Lab., CA (USA)). Aug 1984. Contract AC03-76SF00098. 159p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85004612.

Chart is an interactive graphics program that can be used to create tables of data and to display this data as a table or as a

graph. Several different graphic forms are available, including bar charts, line graphs, and pie charts. Chart is interactive; this means that commands are typed by the user at a terminal and their effects are seen in a few seconds. It is easy to experiment with different display formats and then choose the one that displays your data most effectively. Chart also makes it easy to start with a simple table and then gradually add additional features such as titles, footnotes, and complex column headings in gradual steps. Each step gives the user a clearer idea of what the final published table or graph should look like in order to best communicate the meaning of the data. This manual provides an introduction to using Chart and at the end of the course you will be able to produce tables and graphic displays like those shown in Figures 1 through 4. The Introduction to Chart course assumes that the user has taken the Introduction to the Distributed Computer Network course or can demonstrate knowledge of the topics covered in that course.

12016 **(SOL—84-10) Software and its relationship to methods.** Gill, P.E.; Murray, W.; Saunders, M.A.; Wright, M.H. (Stanford Univ., CA (USA). Systems Optimization Lab.). Nov 1984. Contract AT03-76ER72018. 18p. (CONF-8406233—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85004784.

From SIAM conference on numerical optimization; Boulder, CO, USA (12 Jun 1984).

One view of numerical software is that it is simply a computer implementation of a known method. Implicit in this view is the assumption that the flow of information is in one direction only. However, developments in methods and software are intimately related, and neither is complete if considered in isolation. In this paper, we illustrate how the development of numerical software has influenced our research in optimization methods.

12017 **(UCID—30189-Rev.1) CLARET user's manual: Mainframe Logs. Revision 1.** Frobose, R.H. (Lawrence Livermore National Lab., CA (USA)). 12 Nov 1984. Contract W-7405-ENG-48. 42p. NTIS, PC A03. File Number DE85006155.

CLARET (Computer Logging and RETrieval) is a stand-alone PDP 11/23 system that can support 16 terminals. It provides a forms-oriented front end by which operators enter online activity logs for the Lawrence Livermore National Laboratory's OCTOPUS computer network. The logs are stored on the PDP 11/23 disks for later retrieval, and hardcopy reports are generated both automatically and upon request. Online viewing of the current logs is provided to management. As each day's logs are completed, the information is automatically sent to a CRAY and included in an online database system. The terminal used for the CLARET system is a dual-port Hewlett Packard 2626 terminal that can be used as either the CLARET logging station or as an independent OCTOPUS terminal. Because this is a stand-alone system, it does not depend on the availability of the OCTOPUS network to run and, in the event of a power failure, can be brought up independently.

12018 **(UCRL—15645) User's and programmer's guide to the mechanics of Moving Finite Element code.** Sincovec, R.F.; Aslam, S. (Colorado Univ., Denver (USA). Dept. of Electrical Engineering). 1984. Contract W-7405-ENG-48. 71p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85006165.

This document presents the details of the mathematics of the Moving Finite Element (MFE) method. Our code is a direct implementation of the mathematical mechanics. Our intent is to give the prospective user insight into how the code works, and we present sufficient material so that the user can modify the code if desired. This document also serves as a programmer's guide. This document is in no way a complete treatise on the MFE method; the user is referred to references which appear at the end of this document.

12019 **Three-cocycle in mathematics and physics.** Jackiw, R. (Center for Theoretical Physics, Laboratory for Nuclear Science, Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Physical Review Letters;* **54**: No. 3, 159-162(21 Jan 1985). Contract AC02-76ER03069.

It is shown that the three-cocycle arises when a representation of a transformation group is nonassociative, so that the Jacobi identity fails. A physical setting is given: When the translation group in the presence of a magnetic monopole is represented by gauge-invariant operators, a (trivial) three-cocycle occurs. Insisting that finite translations be associative leads to Dirac's monopole quantization condition. Attention is called to the possible relevance of three-cocycles in the quark model's U(6) x U(6) algebra.

12020 **Existence and Computation of LU-factorization with small pivots.** Chan, T.F. (Santa Barbara Research Center, Goleta, California 93117). *Mathematics of Computation;* **42**: No. 166, 535-547(Apr 1984). Contract AC02-81ER10996.

Let A be an n by n matrix which may be singular with a one-dimensional null space, and consider the LU-factorization of A. When A is exactly singular, we show conditions under which a pivoting strategy will produce a zero nth pivot. When A is not singular, we show conditions under which a pivoting strategy will produce an nth pivot that is $O(\sigma/\text{sub n/})$ or $O(\kappa^{-1}(A))$, where $\sigma/$ sub n/ is the smallest singular value of A and $\kappa(A)$ is the condition number of A. These conditions are expressed in terms of the elements of A^{-1} in general but reduce to conditions on the elements of the singular vectors corresponding to $\sigma/$sub n/ when A is nearly or exactly singular. They can be used to build a 2-pass factorization algorithm which is guaranteed to produce a small nth pivot for nearly singular matrices. As an example, we exhibit an LU-factorization of the n by n upper triangular matrix.

12021 **Preconditioning by incomplete block cyclic reduction.** Rodrigue, G.; Wolitzer, D. (Santa Barbara Research Center, Goleta, California 93117). *Mathematics of Computation;* **42**: No. 166, 549-565(Apr 1984). Contract W-7405-ENG-48.

Iterative methods for solving linear systems arising from the discretization of elliptic/parabolic partial differential equations require the use of preconditioners to gain increased rates of convergence. Preconditioners arising from incomplete factorizations have been shown to be very effective. However, the recursiveness of these methods can offset these gains somewhat on a vector processor. In this paper, an incomplete factorization based on block cyclic reduction is developed. It is shown that under block diagonal dominance conditions the off-diagonal terms decay quadratically, yielding more effective algorithms.

12022 **Modified Method for Reconstructing periodic Jacobi matrices.** Boley, D.; Golub, G.H. (Santa Barbara Research Center, Goleta, California 93117). *Mathematics of Computation;* **42**: No. 165, 143-150(Jan 1984). Contract AT03-76ER71030.

In this note, we discuss the reconstruction of periodic Jacobi matrices from spectral data. The method combines ideas and techniques from the algorithms given by Boley and Golub [1], [2], and Ferguson [3], resulting in a numerically stable algorithm applicable to a larger class of problems. The number of initial data items needed for this method equals the number of items in the resulting matrix, namely 2n.

12023 **Vibrational control of systems with Arrhenius dynamics.** Bellman, R.; Bentsman, J.; Meerkov, S.M. (Univ. of Southern California, Los Angeles). *Journal of Mathematical Analysis and Applications;* **91**: No. 1, 22-61(Jan 1983). Contract AC02-80ER10709.

A nonlinear system with S-shape steady state characteristic is referred to as a system with Arrhenius dynamics. The negative slope part of the S-shape curve represents a set of unstable steady states. Using two examples of Arrhenius systems (catalytic reactor and continuous stirred tank reactor), it is shown that introduction of sufficiently fast oscillations in the parameters of the system generates a new Arrhenius system, the steady state characteristic of which has a smaller negative slope part. Results of analytical investigation as well as numerical simulation are presented. It is shown that vibrational stabilization of Arrhenius systems gives an increase in productivity of the plants.

9903 Information Handling

REFER ALSO TO CITATION(S) 99030010841, 11147

12024 **(DOE/DP—0021) CG-DAR-1: Guide to the declassified areas of nuclear energy research.** Lytle, J.E. (USDOE Assistant Secretary for Defense Programs, Washington, DC. Office of Classification). Aug 1984. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE84017499.

This guide, which is based on classification of information by the Atomic Energy Act of 1954, as amended, and on subsequent declassification actions by the Department of Energy (DOE) and its predecessors, is intended to identify those areas of nuclear research and development that have been removed from the Restricted Data (RD) category and declassified.

12025 **(DOE/ER—0192) Technology Transfer '83. Fiscal year annual report. Research and Development Laboratory technology transfer program.** (USDOE Office of Energy Research, Washington, DC). Dec 1984. 66p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85004977.

Industrial innovation is central to the economic well-being of the United States. Over the years, the technology generated in mission areas of the Department of Energy has been reapplied by industry for use in commercial products and processes. Nuclear power, nuclear medicine, radiation processing, ion implantation, materials advances, and supercomputers are but a few of the extensive technology transfers that have come about as a result of research and development sponsored by the Department. The purpose of the research and development laboratory technology transfer program is to better organize and accelerate this spin-off process. The Department of Energy laboratories are world class research and development organizations. We are taking steps to facilitate an interactive atmosphere among the laboratories and industry, State and local governments, and universities. The practical benefits to the Nation are reported here.

12026 **(DOE/NBM—1078) Study of the value of information and the effect on value of intermediary organizations, timeliness of services and products, and comprehensiveness of the EDB. Volume 1, Volume 2, and Volume 3.** King, D.W.; Griffiths, J.M.; Sweet, E.A.; Wiederkehr, R.R.V.; Roderer, N.K. (King Research, Inc., Rockville, MD (USA)). Sep 1984. 128p. NTIS, PC A07/MF A01; GPO Dep. File Number DE85003670.

A previous study demonstrated that energy information has substantial value when considered from the standpoints of amount of use, purposes of use, and value measured by what users are willing to pay for the information and the savings in labor, equipment, etc., derived from use of the information. Furthermore, energy information services and products derived from the Energy Data Base clearly contribute greatly to the value of energy information by making it more accessible and, therefore, more usable. The purpose of this study was to determine what contribution intermediary information transfer organizations such as libraries and information analysis centers make to the value of information. Also, other factors such as timeliness of primary publishing and distribution and comprehensiveness of the Energy Data Base were considered to be important as well. The results are presented in 3 sections (volumes). Volume 1 gives an analysis of the value of the services provided by libraries. The library study estimated the value of library services (in terms of willingness to pay and savings). It also provided the relationships of the use of library services and factors such as performance attributes (i.e., quality and timeliness of services), distance to the library, awareness of services and economics of library use. Volume 2 gives results of a study of two software Information Analysis Centers and the value of software that is attributable to the centers. Volume 3 provides an analysis of the value of the timeliness and comprehensiveness of the Energy Data Base. Separate abstracts have been prepared for each section for inclusion in the Energy Data Base. (DMC)

12027 (DOE/NBM—1078, pp ii-60) **Value of libraries as an intermediary information service. Volume 1.** King, D.W.; Griffiths, J.M.; Sweet, E.A.; Wiederkehr, R.R.V. Sep 1984. NTIS, PC A07/MF A01. File Number DE85003670.

In Study of the value of information and the effect on value of intermediary organizations, timeliness of services and products, and comprehensiveness of the EDB. Volume 1, Volume 2, and Volume 3.

An investigation has been performed to determine what contribution intermediary information transfer organizations such as libraries and information analysis centers make to the value of information. Also, other factors such as timeliness of primary publishing and distribution and comprehensiveness of the Energy Data Base were considered. The purpose of this part of the study was to determine how much typical libraries that serve professionals such as scientists and engineers contribute to the value of information. Evaluations were performed on library services provided at three locations: Rocky Flats, Rockwell Energy Systems Group and Oak Ridge National laboratory (ORNL). Information was also obtained from a general survey of scientists and engineers found in nine fields of science. The basic approach in this investigation involved estimating the value of energy information using a slightly revised method of calculating value than that used in the previous report. An estimate is presented of the amount and purposes of reading of journal articles, technical reports and books in the three locations. The time spent reading is also estimated, which is a major contributing factor to what users are willing to pay for information read. Also, value of information is estimated in terms of what users are willing to pay for it. Finally, value is estimated in terms of what savings (in time and equipment) are achieved from reading. The amount of value attributable to the libraries serving the three locations above is then estimated and results are presented which describe the performance and effectiveness of their services. An attempt was made to relate librarian capabilities to performance, performance to effectiveness and performance to value (all for search services). 8 figures, 20 tables. (DMC)

12028 (DOE/NBM—1078, pp 61-85) **Value of the National Energy Software Center and the Radiation Shielding Information Center. Volume 2.** Roderer, N.K. Sep 1984. NTIS, PC A07/MF A01. File Number DE85003670.

In Study of the value of information and the effect on value of intermediary organizations, timeliness of services and products, and comprehensiveness of the EDB. Volume 1, Volume 2, and Volume 3.

An investigation was performed to determine what contributions intermediary information transfer organizations such as libraries and information analysis centers make to the value of information. The purpose of this part of the report is to study the value of information analysis centers such as the National Energy Software Center (NESC) and the Radiation Shielding Information Center (RSIC). The roles played by NESC and RSIC in the software information chain are discussed. The major features of each organization and costs associated with the services provided are described. Results from the two organizations are combined to support the nature of the benefits derived from such services and their potential relationships to productivity. 4 references, 1 figure, 6 tables. (DMC)

12029 (DOE/NBM—1078, pp 86-122) **Effect of timeliness and comprehensiveness on value. Volume 3.** King, D.W.; Griffiths, J.M.; Sweet, E.A.; Wiederkehr, R.R.V. Sep 1984. NTIS, PC A07/MF A01. File Number DE85003670.

In Study of the value of information and the effect on value of intermediary organizations, timeliness of services and products, and comprehensiveness of the EDB. Volume 1, Volume 2, and Volume 3.

A study has been performed to determine what contribution intermediary information transfer organizations such as libraries and information analysis centers make to the value of information. Also, other factors such as timeliness of primary publishing and distribution and comprehensiveness of the Energy Data Base were considered to be important as well. The purpose of this part of the study is to determine the effect that timeliness and comprehensiveness have on the value of information. Timeliness is analyzed from the standpoint of the delay of publishing, delay in getting copies of technical reports and articles, delay in publishing bibliographic databases, and delay in conducting reference searches on-request. The value of non-US materials and the cross-cutting nature of the subject fields required by DOE scientists and engineers are also examined. This was done by comparing the subject categories of online

searches that were performed by DOE funded researchers against the subject categorization of the research project for which the search was being performed. The relevance of search response to the research project as well as to general interest of the researcher was also determined. 2 figures, 16 tables. (DMC)

12030 **(N—84-31049) Government acronyms and alphabetic organizational designations used in DTIC (Defense Technical Information Center).** Brown, L.M. (Defense Technical Information Center, Alexandria, VA (USA)). May 1984. 268p. (AD-A—142700). NTIS, PC A12/MF A01.

A guide to acronyms as assigned by the Defense Technical Information Center (DTIC) is given. The listing contains entries from the Department of Defense, Federal Government and foreign military organizations. The acronyms reflect reports processed into the DTIC collections.

12031 **Maximum ratio: a tool for assisting inaccuracy assessment.** Tsao, H.; Wright, T. (Oak Ridge National Lab., TN). *American Statistician;* **37**: No. 4, 339-342(Nov 1983). Contract W-7405-ENG-26.

A simple tool, called the maximum ratio, is described that serves as a measure of closeness among comparable estimates and as the basis of a test for determining that at least one of the estimates under comparison will be more than $100\alpha\%$ of the target parameter away from the target parameter being estimated where $0 < \alpha < 1$.

CORPORATE AUTHOR INDEX

In the Corporate Author Index, report literature is indexed using the name of the organization or institution responsible for issuing the report. Headings are provided for all report literature and for published literature for which a corporate approach is especially desirable, e.g., symposium and conference proceedings.

Each entry under a corporate heading gives the document title and the volume and abstract numbers. The document type, e.g., R for Report; country of publication, e.g., US; and language of the document, e.g., In German, are given in parentheses at the end of the entry. If no language statement appears, the language is English. Tables of document types and country of publication codes appear after the indexes.

DOE Energy Data Base: Corporate Author Entries (DOE/TIC-4585) is used in the standardization of corporate entries. DOE/TIC-4585 is available for purchase from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, Virginia 22161.

A

Aerojet Ordnance Co., Jonesboro, TN (USA)
Evaluation and demonstration of the viability of salt bath solution heat treatment for D.U. penetrators. Final report, 10:11480 (R;US)

Aerospace Corp., El Segundo, CA (USA). Space Sciences Lab.
Charge-state composition of 0.4-MeV helium ions in earth's outer radiation belts during quiet times. Technical report, 10:11734 (R;US)

Air Products and Chemicals, Inc., Allentown, PA (USA)
Existing technology transfer report dissolver cold-flow modelling, 10:10836 (R;US)

Alaska Univ., Fairbanks (USA)
Northern Plant Documentation Center, 1980-1983. Final report, 10:11615 (R;US)

Alaska Univ., Fairbanks (USA). Inst. of Arctic Biology
Development of Northern Plant Documentation Center. Final report, 10:11664 (R;US)

Ames Lab., IA (USA)
Applications of NMR to the dynamics of carbohydrates; simplifying NMR spectra of proteins, 10:11641 (R;US)
Coal cleaning by froth flotation, 10:10913 (R;US)
Density of gap states in hydrogenated amorphous silicon, 10:11409 (R;US)
Particle detector performance in a Fermilab experiment, 10:11548 (R;US)
Recovery of ethanol from low concentration solution by adsorption with Silicalite, 10:11021 (R;US)
Selectivity variations in anion chromatography, 10:11428 (R;US)
Simple molybdate selective oxidation catalysts containing excess MoO_3 for C_4 hydrocarbon oxidation to maleic anhydride, 10:11462 (R;US)
Studies of cation exchange for the isolation and concentration of trace level components of complex aqueous mixtures, 10:10974 (R;US)
Study of charm production in proton-proton interactions at $\sqrt{s}$ = 62 GeV with a forward K^- trigger, 10:11823 (R;US)
Synthesis and characterization of tetranuclear molybdenum iodide clusters, 10:11444 (R;US)
Synthesis and reactivity of heterodinuclear iron, ruthenium, and cobalt compounds containing bridging dithiomethylene ligands. Attempted synthesis of the iron carbyne compound $Cp(CO)FeCSCH_3$, 10:11461 (R;US)
Vibrational frequencies and structural properties of transition metals via total-energy calculations, 10:11339 (R;US)

Argonne National Lab., Idaho Falls, ID (USA)
Criticality safety training at the Hot Fuel Examination Facility, 10:11482 (R;US)
Final results of the internal ^{235}U sample intercomparison and the half-life of ^{234}U, 10:11882 (R;US)
Simultaneous evaluation of interrelated cross sections by generalized least-squares and related data file requirements, 10:11862 (R;US)

Argonne National Lab., IL (USA)
Blackness coefficients, effective diffusion parameters, and control rod worths for thermal reactors - methods, 10:11129 (R;US)
Block-implicit multigrid solution of Navier-Stokes equations in primitive variables, 10:11803 (R;US)
Data preprocessor and compactor for the Soudan 2 nucleon decay experiment, 10:11558 (R;US)
Development of aqueous batteries for electric vehicles. Summary report, October 1981-December 1983, 10:11318 (R;US)
Distribution of radium and plutonium in human bone, 10:11672 (R;US)
Economics of hydrogen production, 10:11010 (R;US)
Electronic properties of new organic conductors, 10:11411 (R;US)
Energy from municipal waste: assessment of energy conservation and recovery in municipal wastewater treatment, 10:11011 (R;US)
Field validation of six-particle puff model, 10:11588 (R;US)
Influence of basalt/groundwater interactions on radionuclide migration, 10:10998 (R;US)
Integration of energy/economic models for environmental assessments and policy analysis, 10:11184 (R;US)
Mechanism and kinetics of iron electrode dissolution in KOH electrolytes, 10:11179 (R;US)
Microstructural examination of fast-neutron irradiated Li_2O, 10:11390 (R;US)
Mixing, chemical reaction and flow field development in ducted rockets, 10:11507 (R;US)
Monolithic fuel cells, 10:11226 (R;US)
Monoponucleosis: the wonderful things that monopoles can do to nuclei if they are there, 10:11832 (R;US)
Neutron scattering investigation of magnetic excitations at high energy transfers, 10:11389 (R;US)
Neutronics study of LEU fuel options for the HFR-Petten, 10:11133 (R;US)
Nucleon-nucleon interaction at medium energies, 10:11865 (R;US)
Physics at $10^{34}\ cm^{-2}\ s^{-1}$, 10:11813 (R;US)
Possible error-prone repair of neoplastic transformation induced by fission-spectrum neutrons, 10:11671 (R;US)
pp Interaction Regions, 10:11537 (R;US)
Radiological consequence analysis with HEU and LEU fuels, 10:11159 (R;US)
Radiological safety at Argonne National Laboratory's heavy ion research facility, 10:11542 (R;US)
Report of the Snowmass hadronization group, 10:11833 (R;US)
Residential energy consumption characteristics of minority population groups: trends in demand and patterns of use, 10:11219 (R;US)
Summary report: injection group, 10:11536 (R;US)
Super-collider: progress, options and physics, 10:11529 (R;US)
Tracer diffusion in an ordered alloy: application of the path probability and Monte Carlo methods, 10:11333 (R;US)
Transport studies of several novel organic conductors, 10:11915 (R;US)
US RERTR Program: overview, status and plans, 10:11134 (R;US)

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Arizona Univ., Tucson (USA)
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Army Belvoir Research and Development Center, Fort Belvoir, VA (USA)
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Atomics International Div., Canoga Park, CA (USA)
Electron microprobe analysis of irradiated S8ER cladding, 10:11114 (R;US)
Tensile and stress rupture tests of S8DR Hastelloy-N heats: ORNL verification tests, 10:11344 (R;US)
Australian Coal Industry Research Labs. Ltd., North Ryde
Gas drainage by horizontal longhole drilling: field trials at Tahmoor Colliery, 10:10893 (R;AU)

B

Barkas (Walter II), Vaughn, WA (USA)
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Berkeley Geosciences Associates, CA (USA)
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Beschleunigerlaboratorium der Univ. und Technischen Univ. Muenchen, Garching (Germany, F.R.)
Observations on the Munich MP arc discharge conditioning test, 10:11530 (R;US)
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Nuclear reaction n + ^{3}He -> ^{1}H + ^{3}H as proximity reaction, 10:11869 (R;DE;In German)
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Finite-size scaling for quantum chains with an oscillatory energy gap, 10:11917 (R;DE)
Quantum mechanics with extended supersymmetry and nonabelian gauge constraints, 10:11850 (R;DE)
Stochastic variables in N=1 supersymmetric Yang-Mills theory, 10:11852 (R;DE)
Use of MC68000 microprocessors in the TASSO experiment, 10:11556 (R;DE)
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How dangerous are routine X-ray checkups, 10:11657 (R;DE;In German)
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Brookhaven National Lab., Upton, NY (USA)
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Analysis of ex-vessel debris/water interaction and a potential overpressurization of containment, 10:11139 (R;US)
Applications of the vibration probe to localized current measurements, 10:11326 (R;US)
Bar code instrumentation for nuclear safeguards, 10:11004 (R;US)
BEAGL-01: a computer code for calculating rapid LWR core transients. Volume 2. User's manual, 10:11160 (R;US)
Breeding nuclear fuels with accelerators: replacement for breeder reactors, 10:11540 (R;US)
Brookhaven National Laboratory's low cost solar technology, 10:11054 (R;US)
Characteristics of synchrotron radiation, 10:11539 (R;US)
Charge changing cross sections of relativistic uranium, 10:11551 (R;US)
Chlorine solar neutrino experiment, 10:11735 (R;US)
Investigation of gap states in a-Si:H using dual beam photoconductivity and photoluminescence, 10:11387 (R;US)
Investigations of molecular orbitals with accel-decel beams, 10:11759 (R;US)
Large-angle positronium emission for Al(110), 10:11760 (R;US)
Least squares fit of thermal data for fissile nuclei, 10:11881 (R;US)
Local electrochemistry of pitting corrosion in stainless steels, 10:11325 (R;US)
Mechanisms of stress corrosion cracking and intergranular attack in Alloy 600 in high temperature caustic and pure water, 10:11327 (R;US)
Optimization of Nb_3Sn, 10:11481 (R;US)
Positron reemission: measurement of thin single crystal W(100) films to be used as transmission moderator or re-moderators, 10:11761 (R;US)
RAMONA-3B, a code for BWR plant transients, 10:11138 (R;US)
Role of optical disk at computing centers, 10:12008 (R;US)
Spot and futures markets for natural gas, 10:10946 (R;US)
Summary report: injection group, 10:11536 (R;US)
Superconducting power transmission system development. Cable insulation development. Semiannual report, 1 October 1983-31 March 1984, 10:11069 (R;US)
Synchrotron radiation production and trapping of highly charged ions, 10:11538 (R;US)
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C

Calgon Corp., Pittsburgh, PA (USA)
Generation and behavior of metal oxide colloids in PWR steam systems, 10:11097 (R;US)
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California Univ., Davis (USA)
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Algorithms and software for pole assignment and observers, 10:11929 (R;US)
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Cerenkov ring imaging detector development for SLD, 10:11570 (R;US)
Cambridge Univ. (UK). Cavendish Lab.
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Development of a single-family absorption chiller for use in a solar heating and cooling system. Phase III, final report. Volume II, 10:11052 (R;US)
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Moderization of the LEOPARD library, 10:11092 (R;BR;In Portuguese)
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Rail coal transportation under the Staggers Act, 10:11214 (R;US)
Chicago Univ., IL (USA)
Phase transitions and dark matter problems, 10:11737 (R;US)
Chicago Univ., IL (USA). Enrico Fermi Inst.
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Superheavy magnetic monopoles and the standard cosmology, 10:11738 (R;US)
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Colorado Univ., Boulder (USA)
Design for small angle (0 to 2mr) spectrometer for ep or anti pp collisions at DO, 10:11560 (R;US)
Lattice Monte Carlo calculations of finite temperature QCD, 10:11851 (R;US)
Sensitization and quenching in the conversion of light energy into chemical energy. Final report, 10:11468 (R;US)
Trigger drift chamber for the MKII upgrade at PEP, 10:11544 (R;US)
Colorado Univ., Boulder (USA). Dept. of Physics
Diffraction: what do we know; what can we learn, 10:11834 (R;US)
Improved b lifetime measurement from MAC, 10:11820 (R;US)
Recent results from PEP, 10:11821 (R;US)
Soliton energetics in extended Peierls-Hubbard models: a quantum Monte Carlo study, 10:11906 (R;US)
Colorado Univ., Denver (USA). Dept. of Electrical Engineering
User's and programmer's guide to the mechanics of Moving Finite Element code, 10:12018 (R;US)
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Self-radiation damage in actinide host phases of nuclear waste forms, 10:10981 (R;US)
Cornell Univ., Ithaca, NY (USA)
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Time resolved x-ray studies during pulsed laser irradiation of Ge, 10:11329 (R;US)
Cornell Univ., Ithaca, NY (USA). Dept. of Materials Science
Evidence for as doping effects on resolidification dynamics during pulsed laser melting, 10:11412 (R;US)
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D

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Defense Technical Information Center, Alexandria, VA (USA)
Government acronyms and alphabetic organizational designations used in DTIC (Defense Technical Information Center), 10:12030 (R;US)
Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)
Charged Dsup(*) production in e^+e^- annihilation, 10:11817 (R;DE)
Comparison of quark and gluon jets, 10:11837 (R;DE)
Evidence for Fsup(*) meson production in e^+e^- annihilation at 10 GeV center-of-mass energy, 10:11816 (R;DE)
Inclusive electron production from heavy quarks in e^+e^- annihilation at 34.6 GeV center of mass energy, 10:11818 (R;DE)
Massive Yang-Mills - an effective Lagrangian for composite Wsup(+-), Z and new coloured vector bosons, 10:11836 (R;DE)
Measurements of energy correlations in $e^+e^- \rightarrow$ hadrons, 10:11814 (R;DE)
Monte Carlo calculation of hadron masses with light dynamical quarks, 10:11835 (R;DE)
Search for heavy quarks in e^+e^- collisions up to 46.78 GeV C.M. energy, 10:11815 (R;DE)
TASSO vertex detector, 10:11557 (R;DE)
Test of a high resolution drift chamber prototype, 10:11559 (R;DE)
Dortmund Univ. (Germany, F.R.)
Weak corrections to the e+e-yields mu+mu- asymmetry, 10:11825 (R;DE)
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Cysts of the semilunar cartilage. Pathogenesis, clinical symptoms and radiology considering also pneumo-arthrographic findings, 10:11653 (R;DE;In German)
Damage of the hepatic mixed functional oxygenase system by CCl_4. Significance of incorporation of C-14-Cl_4 metabolites in vivo, 10:11647 (R;DE)
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Simulation calculations for a catalytic exchange/cryogenic distillation hydrogen isotope separation process, 10:11137 (R;US)
Strontium sorption on Savannah River Plant soils, 10:10999 (R;US)

E

Eastman Kodak Co., Rochester, NY (USA)
Qualification testing of photodiode, semiconductor, silicon 400-2931, 10:11518 (R;US)

Eckerd Coll., St. Petersburg, FL (USA)
Eckerd College Energy Systems Project. Final technical report, 10:11287 (R;US)
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Ability of the TRAC-P1A computer program to predict blowdown, refill, and reflood phenomena during Semiscale Mod-1 experiments, 10:11153 (R;US)
Application of ANSI/ANS-5.1-1979/HEAT5G code to LOFT technical specifications, 10:11132 (R;US)
Assessment of nuclear fuel rod and solid electric heater thermal behavior during the heatup and reflood phases of a large break LOCA, 10:11152 (R;US)
Automated data qualification, 10:11147 (R;US)
Comparison of mass flow calculations using drag disc/turbine transducer (DTT) data from the Transient Flow Calibration Facility, 10:11146 (R;US)
Contribution of instrumentation and control software to system reliability, 10:12012 (R;US)
Damage and failure of previously irradiated fuel rods during a reactivity initiated accident, 10:11151 (R;US)
Development of a cooled coaxial low flow velocimeter, 10:11148 (R;US)
Estimating common cause failure rates for pumps in nuclear reactors, 10:11076 (R;US)
FRAP-T5 uncertainty study of five reactor transient and accident events, 10:11150 (R;US)
Heated thermocouple liquid level system, 10:11122 (R;US)
Hydrogen studies during PBF Severe Fuel Damage tests, 10:11145 (R;US)
INEL User Network Exchange. Volume 1-85, Jan./Feb. 1985, 10:12011 (R;US)
Potential for interactive/real time nuclear power plant simulation with RELAP5, 10:11144 (R;US)
Primary coolant pump measurement for ICC trend analysis, 10:11093 (R;US)
Report on the participation of US laboratories in the work of the IAEA coordinated research program on the measurement and evaluation of transactinium isotope nuclear decay data, 10:11883 (R;US)
Review of experiments to evaluate the ability of electrical heater rods to simulate nuclear fuel rod behavior during postulated loss-of-coolant accidents in light water reactors, 10:11142 (R;US)
Thermocouple modeling, 10:11094 (R;US)
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Aerial radiological monitoring survey, Savannah River Plant, 10:11620 (R;US)
Comprehensive, integrated, remote sensing at DOE sites, 10:11624 (R;US)
Status of the Graphic Overview System in relation to Department of Energy facilities, 10:11622 (R;US)
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Multispectral Remote Sensing at the Savannah River Plant, 10:11623 (R;US)
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Possibilities of heat recovery in induction heating and melting, 10:11313 (TG;GB)
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RETRAN-02: a program for Transient Thermal-hydraulic Analysis of Complex Fluid Flow Systems. Volume 3. User's manual. Revision 2, 10:11174 (R;US)
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Energy International, Inc., Bellevue, WA (USA)
Evaluation of particulate collection devices developed for pressurized fluidized-bed combustors as applied to coal gasification processes, 10:10867 (R;US)
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Environmental Resources Management, Inc., West Chester, PA (USA)
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Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.). Medizinische Fakultaet
Studies on irradiated lactate dehydrogenase using gel electrophoresis, 10:11674 (R;DE;In German)
Exxon Nuclear Co., Inc., Richland, WA (USA)
International training course on implementation of state systems of accounting for and control of nuclear materials: proceedings, 10:11006 (R;US)

F

Fermi National Accelerator Lab., Batavia, IL (USA)
Monoponucleosis: the wonderful things that monopoles can do to nuclei if they are there, 10:11832 (R;US)
Origin of cosmological density fluctuations, 10:11739 (R;US)
Phase transitions and dark matter problems, 10:11737 (R;US)
pp Interaction Regions, 10:11537 (R;US)
Probes of the quark-gluon plasma as it might be produced in ultra-relativistic nuclear collisions, 10:11889 (R;US)
Probing for preon structure via gluons, 10:11840 (R;US)
Standard model and beyond, 10:11853 (R;US)
Summary report: injection group, 10:11536 (R;US)
Superheavy magnetic monopoles and the standard cosmology, 10:11738 (R;US)
Florida Solar Energy Center, Cape Canaveral (USA)
Thermoeconomic optimizarion of OC-OTEC electricity and water production plants. Final report, 10:11050 (R;US)
Florida Univ., Gainesville (USA)
Research in theoretical elementary particle physics. Annual progress report, 10:11838 (R;US)
Flow Industries, Inc., Kent, WA (USA)
Evaluation of particulate collection devices developed for pressurized fluidized-bed combustors as applied to coal gasification processes, 10:10867 (R;US)
Forestry Commission, Edinburgh (UK)
Acid rain and forestry, 10:11591 (R;GB)
Frankfurt Univ. (Germany, F.R.). Inst. fuer Kernphysik
Investigations of molecular orbitals with accel-decel beams, 10:11759 (R;US)
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Selective permit requirements for natural resource development, land use regulation, environmental quality management, social/ecological preservation, and local regulatory policy. Volume 4. Vermont, 10:11627 (R;US)

G

Gas Research Inst., Chicago, IL (USA)
Biogasification products of water hyacinth wastewater reclamation, 10:11012 (R;US)
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Management weaknesses affect Nuclear Regulatory Commission efforts to address safety issues common to nuclear power plants, 10:11115 (R;US)
Status of civilian federal agencies' efforts to address hazardous waste problems on their lands, 10:11187 (R;US)
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Evaluation of the Department of Energy's Economic Regulatory Administration Office in Tulsa, Oklahoma, 10:10945 (R;US)
Funding of generic activities within DOE's Office of Assistant Secretary for Nuclear Energy, 10:11075 (R;US)
Natural resource damage claims and assessment regulations under Superfund, 10:11188 (R;US)
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Studies of a digital approach to neutron dosimetry and microdosimetry, 10:11903 (R;US)
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Coordinated decentralized emergency operating state control, 10:11065 (R;US)
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List of reports on reactor safety research of BMFT, CEA, EPRI, JSTA and USNRC, 10:11162 (R;DE;In German)
Reports of reactor safety research projects sponsored by the Federal Ministry for Research and Technology (BMFT), 10:11161 (R;DE;In German)
Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)
Discovery of element 108 - the island of α-active nuclei beyond element 105, 10:11884 (R;DE)
Dissipation and fluctuation of the relative momentum in nucleus-nucleus collisions, 10:11892 (R;DE)
Intense beams of mass-separated, neutron-deficient indium, tin and lead isotopes, 10:11547 (R;DE)
Mean-field dynamics versus two-body collisions at intermediate energy heavy-ion reactions, 10:11890 (R;DE)
Positron spectroscopy of supercritical heavy ion collision systems, 10:11767 (R;DE)
Quantum interference and statistical fluctuations in deep inelastic heavy-ion reactions, 10:11891 (R;DE)
Reaction mechanisms in the collision of ^{92}Mo on ^{92}Mo at an incident energy of 14.7 MeV/Nucleon, 10:11876 (R;DE;In German)
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Measurement of the radial density distribution of the light emissions near the trajectory of fast ions in nitrogen, 10:11898 (R;DE;In German)
Monte Carlo calculation of energy deposition and ionization yield for high energy protons, 10:11901 (R;US)
Giessen Univ. (Germany, F.R.). Fachbereich Humanmedizin
Normal anatomy and aneurysms of middle cerebral artery. A morphological, neuroradiological and clinical study, 10:11649 (R;DE)
GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)
Energy-supply-independent after-heat removal in nuclear propulsion plants for ships in combination with sinking and cantering, 10:11098 (R;DE;In German)

H

Hanford Engineering Development Lab., Richland, WA (USA)
Charpy impact test results of ferritic alloys at fluence to 6 x 10^{22} n/cm , 10:11338 (R;US)
Effects of irradiation on the fracture toughness of HT-9, 10:11337 (R;US)
Influence of titanium on the neutron-induced swelling of austenitic alloys, 10:11336 (R;US)
LWR Pressure Vessel Surveillance Dosimetry Improvement Program. Semiannual progress report, October 1983-March 1984. Volume 1, 10:11088 (R;US)
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Diagnostics for the NBETF actively cooled beamdump, 10:11977 (R;US)
DOE-2 Building Energy Analysis Program, 10:11290 (R;US)
Effects of fracture roughness on fluid flow through a single deformable fracture, 10:11725 (R;US)
Experiments with heavy beams at the Berkeley Bevalac, 10:11533 (R;US)
Fast readout of CCD images, 10:11517 (R;US)
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Phase transitions in nuclear matter, 10:11893 (R;US)
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Superconducting junction with resonant tunneling, 10:11913 (R;US)
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Coal cleaning by flotation, 10:10917 (R;AU)
Coal firing of the Sirosmelt reactors, 10:10926 (R;AU)
Coal overburden project, 10:10898 (R;AU)
Coal washery reject disposal, 10:10915 (R;AU)
Combustion and heat transfer in pulverised coal fired furnaces, 10:10928 (R;AU)
Comparative study of world blast furnace cokes: behaviour of ash components, 10:10856 (R;AU)
Computer modelling of coal basins, 10:10891 (R;AU)
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Dense phase pneumatic conveying of pulverised coal, 10:10918 (R;AU)
Devolatilisation of brown coal, 10:10859 (R;AU)
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Examination of the mineral components of coal and its resultant fly ash in relation to resistivity characteristics of the fly ash, 10:10855 (R;AU)

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Formation of nitrogen oxides from the combustion of Yallourn brown coal, 10:10927 (R;AU)
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Improved recovery of fine coal, 10:10916 (R;AU)
In seam exploration in coal mines using vibration measurement, 10:10890 (R;AU)
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Mine roadway stabilisation, 10:10896 (R;AU)
Mine ventilation subsequent to explosions and fires, 10:10897 (R;AU)
Oil agglomeration: fundamental studies, 10:10914 (R;AU)
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Planning framework for the accommodation for coal development by Wollongong City, 10:10932 (R;AU)
Prediction and monitoring of roof conditions, 10:10901 (R;AU)
Quantitative characterisation of mineral matter in a range of coals and coal generated materials, 10:10857 (R;AU)
Regeneration of catalysts for use in continuous flow coal hydrogenation, 10:10847 (R;AU)
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Macro for fitting nonlinear models to Poisson distributed data, 10:11927 (R;US)

Oak Ridge Gaseous Diffusion Plant, TN (USA)
Calculation of thermal mixing for the BWR Mark I cantainment pressure suppression pool, 10:11158 (R;US)
Cooling tower wood sampling analyses: a case study, 10:11484 (R;US)
Isotopic analysis of enriched/depleted SO_2 via low-resolution mass sectrometry, 10:11429 (R;US)
Schedule planning for construction projects, 10:12004 (R;US)

Oak Ridge National Lab., TN (USA)
Analysis of uncertainties in CRAC2 calculations: wet deposition and plume rise, 10:11608 (R;US)
Application of zone-matching methodology to interacting submerged multiport diffusers, 10:11123 (R;US)
Areas with forest soils sensitive to acidic deposition under alternative damage hypotheses, 10:11617 (R;US)
Behavior of Cs, I, and Te in the fission product release program at ORNL, 10:11157 (R;US)
Bulk Shielding Facility quarterly report, April, May and June 1984, 10:11136 (R;US)
Calculated k-effectives for plutonium critical experiments. Consolidated Fuel Reprocessing Program, 10:10963 (R;US)
Characterization of soils at proposed Solid Waste Storage Area (SWSA) 7, 10:11625 (R;US)
Characterization of supported metal catalysts by imaging, microdiffraction and microanalysis techniques, 10:11439 (R;US)

Chemical behavior of fission product iodine following LWR accidents, 10:11143 (R;US)
CHIL - a comprehensive histogramming language, 10:12009 (R;US)
Effect of the chemical environment on the L and M heavy-ion-induced x-ray satellite emission spectra, 10:11762 (R;US)
ELMO Bumpy Square, 10:11978 (R;US)
Energy savings one and two years after participation in Minnesota home energy audit and retrofit loan programs, 10:11293 (R;US)
Experimental verification of the behavior of surface flaws in thick-walled steel cylinders during severe thermal shock, 10:11149 (R;US)
Field studies on the terrestrial behavior of actinide elements in East Tennessee, 10:11619 (R;US)
First principles theory of Fermi-surface driven concentration waves in Cu/sub c/Pd/sub 1-c/ alloys, 10:11328 (R;US)
Frontiers of chemistry for americium and curium, 10:11473 (R;US)
Geochemical information for sites contaminated with low-level radioactive wastes: II. St. Louis Airport Storage Site, 10:11003 (R;US)
Geohydrologic characterization of proposed Solid Waste Storage Area (SWSA) 7, 10:10978 (R;US)
High explosive testing of a corrugated metal blast shelter with membrane blast doors, 10:11581 (R;US)
High resolution Z-contrast imaging and lattice location analysis of dopants in ion-implanted silicon, 10:11407 (R;US)
High temperature, high pressure water level sensor, 10:11090 (R;US)
Identification of lignosulfonic acid and humic acid by pyrolysis, gas chromatography and mass spectrometry (Py-GC-MS), 10:11437 (TG;US)
Inhalation toxicology of diesel fuel obscurant aerosol in Sprague-Dawley rats. Final report, Phase 3, subchronic exposures, 10:11687 (R;US)
KENO-V code, 10:11119 (R;US)
Latent heat storage in cooling systems, 10:11286 (R;US)
Macro for fitting nonlinear models to Poisson distributed data, 10:11927 (R;US)
Magnetic studies of $Ni_3Al(Fe)$ compounds, 10:11330 (R;US)
Materials engineering for TFCX, 10:11975 (R;US)
Mobility of toxic compounds from hazardous wastes. Report for January 1982-December 1983, 10:11190 (R;US)
MORSE Monte Carlo code, 10:11120 (R;US)
Multiphoton ionization and excitation of fluoranthene and benzene in solution, 10:11467 (R;US)
New focal plane detector system for the broad range spectrometer, 10:11541 (R;US)
Nuclear physics experiments with the ORNL-HHIRF supersonic gas jet target, 10:11868 (R;US)
Oak Ridge National Laboratory shipping containers for radioactive materials, 10:11486 (R;US)
Observations on the Munich MP arc discharge conditioning test, 10:11530 (R;US)
Overheating and undercooling in silicon during pulsed laser irradiation, 10:11405 (R;US)
Overview of latent storage for passive solar applications, 10:11061 (R;US)
Particulate toughened silicon carbide, 10:11404 (R;US)
Performance characteristics of axisymmetric venturi-like reverse-flow diverters. Consolidated Fuel Reprocessing Program, 10:10964 (R;US)
Potential resources from coal fly ash, 10:10863 (R;US)
Progress in evaluation of radionuclide geochemical information developed by DOE high-level nuclear waste repository site projects. Report for January-March 1984, 10:11001 (R;US)
Proposed solar neutrino experiment using $^{81}Br(nu,e^-)^{81}Kr$, 10:11736 (R;US)
Radionuclide migration pathways analysis for the Oak Ridge Central Waste Disposal Facility on the West Chestnut Ridge site, 10:11002 (R;US)
RADTWO: a computer code for simulating fast-transient, two-dimensional, two-layer radionuclide concentration conditions in lakes, reservoirs, rivers, estuaries, and coastal regions, 10:11636 (R;US)
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 1. Management plan overview and summary, 10:11191 (R;US)
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 4, Appendix D: endangered and threatened plant species, 10:11194 (R;US)
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 5, Appendix E: environmental monitoring, 10:11195 (R;US)
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 6, Appendix F: forest management, 10:11196 (R;US)
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 7, Appendix G: geography, demography, topography, and soils, 10:11197 (R;US)
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 8, Appendix H: geology, 10:11198 (R;US)
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 9, Appendix I: health, safety, and environmental affairs, 10:11199 (R;US)
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 10, Appendix J: hydrology, 10:11200 (R;US)
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 11, Appendix K: site development, 10:11201 (R;US)
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 12, Appendix L: laws, regulations, and guidelines, 10:11202 (R;US)
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 13, Appendix M: Oak Ridge National Environmental Research Park, 10:11203 (R;US)
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 14, Appendix O: utilities, 10:11204 (R;US)
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 15, Appendix P: waste management, 10:11205 (R;US)
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 16, Appendix Q: wildlife management, 10:11206 (R;US)
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 17. Maps, 10:11207 (R;US)
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 2, Appendix A: aquatic habitats, 10:11192 (R;US)
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 3, Appendix B: archaeological considerations, 10:11193 (R;US)
Site characterization of the West Chestnut Ridge site, 10:10977 (R;US)
Small-angle x-ray scattering (SAXS) study of coarsening kinetics in an aluminum-lithium alloy, 10:11331 (R;US)
Sparse matrix computations, 10:11926 (R;US)
Special purpose materials for fusion application, 10:11974 (R;US)
Structure and properties of ion-implanted Al_2O_3, 10:11388 (R;US)
Studies of a digital approach to neutron dosimetry and microdosimetry, 10:11903 (R;US)
Surface Gasification Materials Program. Semiannual progress report for the period ending September 30, 1984, 10:10848 (R;US)
Thermochemical modeling of the plutonium and uranium-plutonium dioxides, 10:11440 (R;US)
Three years after participation: electricity savings due to the BPA Residential Weatherization Pilot Program, 10:11292 (R;US)
Time resolved x-ray studies during pulsed laser irradiation of Ge, 10:11329 (R;US)
Time-resolved studies of rapid solidification in highly undercooled molten silicon, 10:11406 (R;US)
Two-dimensional modeling of sodium boiling in a simulated LMFBR loss-of-flow test, 10:11155 (R;US)
Ultrahigh-resolution studies of heavy-ion-induced x-ray satellite emission, 10:11763 (R;US)
UO_2 aerosol release from pools of sodium, 10:11156 (R;US)

Oak Ridge Y-12 Plant, TN (USA)

Beta-to-alpha phase transformation in a uranium alloy, 10:11352 (R;US)

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Unusual behavior of projectile fragments formed in the bombardment of copper with relativistic Ar ions, 10:11873 (R;US)
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Orkand Corp., Silver Spring, MD (USA)
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Application of the heat pump for concentration by evaporation and for drying in agricultural foodstuffs industries, 10:11312 (TG;GB)
Possibilities of heat recovery in induction heating and melting, 10:11313 (TG;GB)

P

Pacific Northwest Lab., Richland, WA (USA)
Accident-generated radioactive particle source term development for consequence assessment of nuclear fuel cycle facilities, 10:11612 (R;US)
Adequacy of current systems for monitoring extremity exposures at nuclear power plants, 10:11905 (R;US)
Assembly, operation and disassembly manual for the Battelle Large Volume Water Sampler (BLVWS), 10:11637 (R;US)
Birds of the Hanford site: nest site selection, 10:11626 (R;US)
Characterization of chemical waste site contamination and its extent using bioassays, 10:11618 (R;US)
Consequence analysis of a hypothetical contained criticality accident in the Hanford Critical Mass Laboratory, 10:11168 (R;US)
Control technology for radioactive emissions to the atmosphere at US Department of Energy facilities, 10:11611 (R;US)
Description of the plant for solidification of fission products: PAMELA, 10:10994 (TG;US)
Effects of alpha irradiation on barium hollandite and nickel-iron spinel, 10:11410 (R;US)
Effects of radial temperature gradients on glass fracture in simulated high-level waste canisters, 10:10984 (R;US)
Formation of dimethylbenzenediol via acyloin condensation and a reduction-oxidation pathway, 10:11463 (R;US)
^{76}Ge double beta decay experiment at Homestake, 10:11566 (R;US)
Hydrothermal waste package interactions with methane-containing basalt groundwater, 10:10983 (R;US)
Influence of landfills on ground-water quality, 10:11632 (R;US)
Innovative electrical technique for in-place stabilization of contaminated soils, 10:10979 (R;US)
Integrated analytical approach to detailed chemical characterization of coal liquefaction process materials, 10:10861 (R;US)
MAP3S precipitation chemistry network: seventh periodic summary report, 1983, 10:11594 (R;US)
Mean delta-ray energies in ion-molecule collisions, 10:11900 (R;US)
Monte Carlo calculation of energy deposition and ionization yield for high energy protons, 10:11901 (R;US)
Organics contamination of groundwater: an open literature review, 10:11633 (R;US)
OSCAR experiment high-density network data report: Event 4 - April 21-23, 1981, 10:11593 (R;US)
Overview of DOE's biomass thermochemical conversion process, 10:11018 (R;US)
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Process-related effects on chemical composition of direct coal liquefaction materials, 10:10862 (R;US)
Purpose of the Materials Characterization Center, 10:10982 (R;US)
Reference and testing materials available from the Materials Characterization Center, 10:10980 (R;US)
Relationship between burial depth and radiocesium and radiostrontium and their accumulation in crop plants, 10:11621 (R;US)
Remote removal of contaminated equipment from a radiochemical engineering cell, 10:10985 (R;US)
Role of segregated P and S in intergranular stress corrosion cracking of nickel, 10:11346 (R;US)
Rooting depth and distributions of deep-rooted plants in the 200 Area control zone of the Hanford Site, 10:11665 (R;US)
Self-radiation damage in actinide host phases of nuclear waste forms, 10:10981 (R;US)
Stability criteria for storage of compressed air in hard rock reservoirs, 10:11176 (R;US)
Standing crop and production in an undisturbed shrubsteppe community in eastern Washington, 10:11028 (R;US)
Standing crop and production in annual grass communities in Washington and California: a comparison, 10:11027 (R;US)
Test methods to predict long-term corrosion of container materials in repositories, 10:11345 (R;US)
Panametrics, Inc., Waltham, MA (USA)
High temperature, high pressure water level sensor, 10:11090 (R;US)
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Princeton Univ., NJ (USA)
Volume and area of oil fields and their impact on order of discovery, 10:10934 (R;US)
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Far-infrared laser scattering in the ACT-I toroidal device, 10:11944 (R;US)
Fusion gamma diagnostics, 10:11943 (R;US)
Observation of the backward electrostatic ion cyclotron wave, 10:11946 (R;US)
Parasitic excitation of ion Bernstein waves from a Faraday shielded fast wave loop antenna, 10:11945 (R;US)
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Improving the thermal conductivity and storage capacity of European type ceramic tile stoves using olivine, July 15, 1982-June 31, 1984, 10:11288 (R;US)
Pulse Sciences, Inc., San Leandro, CA (USA)
Pulsed power for race track induction accelerators, 10:11528 (R;US)
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Unusual behavior of projectile fragments formed in the bombardment of copper with relativistic Ar ions, 10:11873 (R;US)
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Q

Queen Mary Coll., London (UK)
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R

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Application of far-field models to the disposal of nuclear waste in geologic formations, 10:10991 (R;US)
Expected repository environments in granite: thermal environment, 10:11723 (R;US)
Measured data from the Avery Island Site C heater test, 10:10967 (R;US)

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Imagery and spectroscopy of supernova remnants and H-2 regions, 10:11741 (R;US)

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Americium-241: the most useful isotope of the actinide elements, 10:10957 (R;US)
Americium transfer studies using hollow fiber/extractant membranes, 10:10986 (R;US)
Apparatus for denitration of uranyl nitrate and/or plutonium nitrate, 10:10956 (TG;US)
Bifunctional organophosphorus liquid-liquid extraction reagents: development and applications, 10:11464 (R;US)
Mechanical properties of electrodeposited nickel and copper, 10:11348 (R;US)
Mechanically assembled non-bonded tranducers utilizing PVDF film, 10:11513 (R;US)
Plutonium purification by vacuum distillation, 10:11347 (R;US)

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S

Salomon Bros., Inc., New York (USA)
Indonesian oil and gas, 10:11216 (R;US)

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Behavior of core debris ejected from a pressurized vessel into scaled reactor cavities, 10:11172 (R;US)
Beneficial uses of nuclear byproducts/Sewage Sludge Irradiation Project. Progress report, January-June 1983, 10:11008 (R;US)
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Electronic properties of new organic conductors, 10:11411 (R;US)
Evidence for as doping effects on resolidification dynamics during pulsed laser melting, 10:11412 (R;US)
Geoengineering properties of potential repository units at Yucca Mountain, southern Nevada, 10:10989 (R;US)
High sheet resistance, arsenic implanted polycrystalline silicon for integrated circuit resistors, 10:11519 (R;US)
Interaction of hot solid, core debris with concrete, 10:11171 (R;US)
Mechanisms of dynamic fragmentation: factors governing fragment size, 10:11478 (R;US)
Overview of methods for uncertainty analysis and sensitivity analysis in probabilistic risk assessment, 10:11169 (R;US)
Parametric coherence estimation via convolved correlations, 10:11928 (R;US)
Preliminary observation of large scale UO_2 melt-concrete interactions and sustained steel-concrete interaction with an overlying water pool, 10:11173 (R;US)
Preliminary requirements for the emplacement and retrieval of defense high-level waste (DHLW) tests in the Waste Isolation Pilot Plant (WIPP), 10:10990 (R;US)
Reaction of amorphous NiNb films with crystalline metal overlayers, 10:11350 (R;US)
Regulatory analyses for severe accident issues: an example, 10:11170 (R;US)
Thermodynamic and kinetic studies of pulsed laser annealing from transient conductivity measurements, 10:11349 (R;US)
Transport studies of several novel organic conductors, 10:11915 (R;US)
UPEML: a machine-portable CDC Update emulator, 10:11902 (R;US)

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Isotope studies of Fe-18Cr-3Mo (100) oxidation using Raman spectroscopy, 10:11351 (R;US)
Solid particle receiver experiments: radiant heat test, 10:11059 (R;US)

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Circulating water cooling system for a Camac Crate, 10:11567 (R;US)

FASTBUS software progress, 10:11520 (R;US)
New drift chamber for the Mark II detector at the SLAC Linear Collider, 10:11568 (R;US)
Performance report for Stanford/SLAC Microstore Analog Memory Unit, 10:11552 (R;US)
SLAC Mark II upgrade drift chamber front end electronics, 10:11569 (R;US)
SLAC Scanner Processor: a FASTBUS module for data collection and processing, 10:11554 (R;US)
Stanford Linear Accelerator Center monthly report for November 1984, 10:11546 (R;US)
Vernier Delay Unit, 10:11553 (R;US)

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Estimate of particle fluxes from the IR's at the SSC, 10:11534 (R;US)
Mixing in a stratified recirculating flow, 10:11508 (R;US)
Performance report for Stanford/SLAC Microstore Analog Memory Unit, 10:11552 (R;US)

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Observations on the Munich MP arc discharge conditioning test, 10:11530 (R;US)

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Multiphoton ionization and excitation of fluoranthene and benzene in solution, 10:11467 (R;US)
Proposed solar neutrino experiment using $^{81}Br(nu,e^-)^{81}Kr$, 10:11736 (R;US)

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Application of zone-matching methodology to interacting submerged multiport diffusers, 10:11123 (R;US)

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U

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Segregation of spent N-Reactor fuel by plutonium isotopic content, 10:10965 (R;US)
United Coal Co., Bristol, VA (USA)
Conceptual design and economic analysis for the manufacture of an ultra-clean coal/water mixture. Final report, 10:10910 (R;US)
United Nations Industrial Development Organization, Vienna (Austria)
Enzymatic conversion of cellulosic materials to sugars and alcohol: the technology and its implications, 10:11022 (R;AT)
United Technologies Corp., South Windsor, CT (USA)
Development of molten carbonate fuel cell power plant technology. Quarterly technical progress report No. 19, April 1-June 30, 1984, 10:11273 (R;US)
United Technologies Corp., South Windsor, CT (USA). Power Systems Div.
Phosphoric acid electric utility fuel cell technology development. Technical progress report No. 16, August 1984, 10:11275 (R;US)
Phosphoric and electric utility fuel cell technology development. Technical progress report No. 18, October 1984, 10:11277 (R;US)
University of Manchester Inst. of Science and Technology (UK). Corrosion and Protection Centre
Local electrochemistry of pitting corrosion in stainless steels, 10:11325 (R;US)
University of Southern California, Los Angeles (USA)
Probing for preon structure via gluons, 10:11840 (R;US)
University of Southern Mississippi, Hattiesburg (USA). Dept. of Chemistry
Tritium analysis of the Tatum Salt Dome Area, 10:11635 (R;US)
University of South Florida, Tampa (USA). Dept. of Chemistry
Identification of polycyclic aromatic compounds containing two heteroatoms in coal liquids and shale oils. Incremental funding request and annual progress report, December 1, 1983-November 31, 1984, 10:10850 (R;US)
University of Western Ontario, London (Canada). Dept. of Physics
Large-angle positronium emission for Al(110), 10:11760 (R;US)
USDOE Assistant Secretary for Defense Programs, Washington, DC
Long-Range Master Plan for Defense Transuranic Waste Management, 10:10972 (R;US)
USDOE Assistant Secretary for Defense Programs, Washington, DC. Office of Classification
CG-DAR-1: Guide to the declassified areas of nuclear energy research, 10:12024 (R;US)
USDOE Assistant Secretary for Fossil Energy, Washington, DC
Unconventional natural gas, 10:10949 (R;US)
USDOE Assistant Secretary for Management and Administration, Washington, DC. Directorate of Procurement and Assistance Management
Department of Energy annual procurement and federal assistance report, FY 1984, 10:12003 (R;US)
USDOE Assistant Secretary for Policy, Safety and Environment, Washington, DC
Increasing competition in the natural gas market, 10:10948 (R;US)
USDOE Bartlesville Project Office, OK (USA)
Contracts for field projects and supporting research on enhanced oil recovery. Progress Review No. 39, quarter ending June 30, 1984, 10:10935 (R;US)
USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels
Commercial Nuclear Power 1984: prospects for the United States and the World, 10:11074 (R;US)
Quarterly coal report, July-September 1984, 10:10930 (R;US)
USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use
Model documentation for the mini-macroeconomic model: MINMAC, 10:11182 (R;US)
USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas
Natural Gas Monthly, October 1984, 10:10947 (R;US)
Petroleum Marketing Monthly, October 1984, 10:10941 (R;US)
USDOE Office of Energy Research, Washington, DC
Technology Transfer '83. Fiscal year annual report. Research and Development Laboratory technology transfer program, 10:12025 (R;US)
USDOE Office of Energy Research, Washington, DC. High Energy Physics Div.
Summaries of FY 1984 research in high energy physics, 10:11809 (R;US)
USDOE Office of Energy Research, Washington, DC. Office of Basic Energy Sciences
Materials Sciences Division long range plan, 10:11322 (R;US)
USDOE Office of Scientific and Technical Information, Oak Ridge, TN
Heavy-Ion Reactions: a current awareness bulletin, 10:11863 (R;US)
In-situ coal gasification: a bibliography, 10:10844 (R;US)
USDOE, Washington, DC
Environmental assessment: DOE program to improve uranium utilization in light water reactors, 10:11125 (R;US)
Integration of energy/economic models for environmental assessments and policy analysis, 10:11184 (R;US)
Replacement cost of domestic crude oil, 10:10940 (R;US)
Role of pilot plants in the development of U-Gas commercial reactor design, 10:10829 (R;US)
Utah Univ., Salt Lake City (USA). Dept. of Fuels Engineering
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 1, October-December 1983, 10:11458 (R;US)
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 4, July-September 1984, 10:11459 (R;US)
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 3, April-June 1984, 10:11460 (R;US)

V

Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)
D-xylose fermentation by fusarium oxysporum and other fungi, 10:11023 (R;FI)
Varian Associates, Inc., Palo Alto, CA (USA)
60 GHz, 200 kW CW gyrotron with high output mode purity, 10:11973 (R;US)
Versuchsgrubengesellschaft m.b.H., Dortmund (Germany, F.R.)
Detection of fire hazards in belt conveyors in coal mines, 10:10905 (TG;GB)
Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Dept. of Mining and Minerals Engineering
Preparation of super-clean coal. Technical progress report for third and fourth quarters, March 15, 1984-September 14, 1984, 10:10911 (R;US)
Virginia Univ., Charlottesville (USA). Dept. of Physics
Nuclear physics experiments with the ORNL-HHIRF supersonic gas jet target, 10:11868 (R;US)
Vowell (R. Charles), Unalaska, AK (USA)
Crab waste methane digester. Final report, 10:11014 (R;US)
VTN Consolidated, Inc., Irvine, CA (USA)
BX In Situ Oil Shale Project. Environmental Mitigation and Monitoring Plan (revised September 1981), 10:10955 (R;US)

W

Washington Univ., Seattle (USA)
Cutaneous melanoma in two populations occupationally exposed to internal deposition of plutonium, 10:11673 (R;US)
Weizmann Inst. of Science, Rehovoth (Israel)
Investigations of molecular orbitals with accel-decel beams, 10:11759 (R;US)
Monoponucleosis: the wonderful things that monopoles can do to nuclei if they are there, 10:11832 (R;US)
Westinghouse Electric Corp., Concordville, PA (USA). Combustion Turbine Systems Div.
Coal water mixture combustion in Multiannular Sw[illegible] (MASB). Low Emission Combustor Technolog[illegible] Draft, 10:10924 (R;US)

Westinghouse Electric Corp., Mercury, NV (USA). Waste Technology Services Div.
Commercial Nuclear Waste Research and Development Program. Annual report, fiscal year 1984, 10:10968 (R;US)
Westinghouse Electric Corp., Philadelphia, PA (USA)
Research and development for advanced combined NO/sub x// SO_2 removal systems. Technical progress report No. 15, October 29, 1984-November 30, 1984, 10:10869 (R;US)
Westinghouse Electric Corp., Pittsburgh, PA (USA)
Investigation of doubly-fed machine in variable speed application, 10:11063 (R;US)
Research and development for advanced combined NO/sub x// SO_2 removal systems. Technical progress report, 10:10868 (R;US)
Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center
50 kW on-site concentrating solar photovoltaic power system. Phase I: design. Final report, 1 June 1978-28 February 1979, 10:11043 (R;US)
Westinghouse Idaho Nuclear Co., Inc., Idaho Falls (USA)
Decontamination and decommissioning of CPP-603 BIF filter room. Final report, 10:10993 (R;US)
Wisconsin Univ., Madison (USA)
Protection of Lexan from uv radiation by photodownconversion. Final report, 10:11056 (R;US)
Reaction of amorphous NiNb films with crystalline metal overlayers, 10:11350 (R;US)
Wisconsin Univ., Madison (USA). Dept. of Physics
Some comments on α/sub s/ and Λ/sub anti MS/, 10:11841 (R;US)
Wisconsin Univ., Milwaukee (USA)
Interaction of low energy electrons with surface lattice vibrations. Final report, 10:11764 (R;US)
World Wildlife Fund, Washington, DC (USA)
Corporate use of information regarding natural resources and environmental quality, 10:11186 (R;US)
Wormser Engineering, Inc., Woburn, MA (USA)
First-year's operation of a full-scale second-generation FBC in an industrial plant, 10:10921 (R;US)
Wuerzburg Univ. (Germany, F.R.). Medizinische Fakultaet
Experiments for improving the roentgen imaging and thus the caries diagnosis in the approximal space of lateral teeth, 10:11648 (R;DE;In German)
Wuppertal Univ. (Gesamthochschule) (Germany, F.R.). Fachbereich 8 - Naturwissenschaften 1 - Physik
Production and testing of an s-band resonator with a Nb_3Sn surface, 10:11555 (R;DE;In German)

X

XDATA Corp., Indianapolis, IN (USA)
Computerized underground image reconstruction. Progress report, July 15, 1982-April 15, 1983, 10:11483 (R;US)
Xerox Palo Alto Research Center, CA (USA)
Structural and electronic properties of amorphous-silicon-based alloy materials. Final report, June 1983-May 1984, 10:11037 (R;US)

PERSONAL AUTHOR INDEX

Authors' surnames are indexed in the form appearing in the abstracted publication; given names are reduced to initials. Each author entry gives the publication title and the citation number. The document type, e.g., R for Report; country of publication, e.g., US; and language of the document, e.g., In German; are given in parentheses at the end of the entry. If no language statement appears, the language is English. Tables of document types and country of publication codes appear after the indexes. For publications with multiple authors, an entry is provided for each author. Entries for the second and succeeding authors give references to the first author.

Because of problems involved in the mechanical preparation of this index, all accent marks are omitted. Changes in spelling introduced as a result of accent omission follow standard conventions.

A

Abashian, A., Particles and fields - 1983, 10:11811 (B;US)

Abens, S., Small methanol powerplant progress, 10:11257 (RA;US)

Abuaf, N., *See* Greene, G.A., 10:11512

Ackerman, J.P., *See* Fee, D.C., 10:11226, 10:11230, 10:11245

See Pierce, R.D., 10:11229

Acton, R., *See* Gronager, J.E., 10:11173

Adams, A.A., Carbon monoxide tolerant anodes and freeze resistant electrodes, 10:11259 (RA;US)

Adams, J.P., *See* Arave, A.E., 10:11093

Adams, L.M., Survival of mammary epithelial cells from virgin female BALB/c mice following in vivo gamma irradiation, 10:11680 (J;US)

Adamson, L.F., *See* Livesey, J.C., 10:11676

Adel, G.T., *See* Yonn, R.H., 10:10911

Adler, H.I., New techniques for growing anaerobic bacteria: experiments with Clostridium butyricum and Clostridium acetobutylicum, 10:11663 (J;US)

Agarwal, P.D., Impact of electric cars on national energy consumption, 10:11302 (J;US)

Aihara, H., Evidence for the F/sup / meson, 10:11830 (J;US)

Ainsworth, E.J., *See* Hanson, W.R., 10:11681

Akbar, S.A., *See* Sato, Hiroshi, 10:11333

Ake, T.R., Recovery of ethanol from low concentration solution by adsorption with Silicalite, 10:11021 (R;US)

Akimaru, S., High pressure type PAFC development for concentrated generation, 10:11267 (RA;US)

Aktas, Y., *See* Willett, J.E., 10:11971

Albrecht, H., Evidence for Fsup(*) meson production in e^+e^- annihilation at 10 GeV center-of-mass energy, 10:11816 (R;DE)

Albright, C.H., Probing for preon structure via gluons, 10:11840 (R;US)

Alcouffe, R.E., User's guide for TWODANT: a code package for two-dimensional, diffusion-accelerated, neutral-particle transport. Revision 1, 10:11899 (R;US)

Alderdice, L., Vegetative response to topsoil versus alternative growth materials in a four-year old study in Kentucky, 10:10874 (RA;US)

Aldred, A.T., *See* Troc, R., 10:11403

Aldrup, D.W., *See* McDowell, W.J., 10:11433

Aleklett, K., *See* Dersch, G., 10:11873

Alexander, J.M., *See* Jacquet, D., 10:11886

Alivisatos, A.P., Nonclassical behavior of energy transfer from molecules to metal surfaces: Biacetyl($^3n\pi^*$)/Ag(111), 10:11775 (J;US)

Alkire, R.C., *See* Ulrich, R.K., 10:11372

Allan, J., Gas drainage by horizontal longhole drilling: field trials at Tahmoor Colliery, 10:10893 (R;AU)

Allen, D.C., *See* Daniels, E., 10:11178

Allen, J., RLE Progress Report No. 126, 10:11732 (R;US)

Allen, J.D., *See* Dils, R.R., 10:11391

Allen, L., *See* Connor, J.W., 10:11969

Allen, R.D., Influence of landfills on ground-water quality, 10:11632 (R;US)

Stability criteria for storage of compressed air in hard rock reservoirs, 10:11176 (R;US)

Allman, S.L., *See* Hurst, G.S., 10:11736

Alonso, J.R., Thirty years at the forefront: a perspective on the Bevatron/Bevalac, 10:11549 (R;US)

Alpi, A., Effects of O_2 concentration on rice seedlings, 10:11696 (J;US)

Alston-Garnjost, M., *See* Aihara, H., 10:11830

Althoff, M., Inclusive electron production from heavy quarks in e^+e^- annihilation at 34.6 GeV center of mass energy, 10:11818 (R;DE)

Amos, D.F., *See* Bell, J.C., 10:10875

An, Z.G., *See* Holmes, J.A., 10:11953

Anahara, R., *See* Kishida, K., 10:11266

See Yonehara, M., 10:11271

Anders, L., *See* van Tendeloo, G., 10:11399

Anderson, A.B., *See* Wackerle, J., 10:11584

Anderson, J.M., Fuel cells for chlor-alkali plants, 10:11251 (RA;US)

Anderson, J.V., Heated thermocouple liquid level system, 10:11122 (R;US)

Anderson, R.E., *See* Ullmann, J.L., 10:11878

Anderson, R.J., *See* Hamilton, J.C., 10:11351

Anderson, R.L., *See* Miller, G.N., 10:11090

Anderson, W.A., Thin-film polycrystalline silicon research. Final report, August 1983-August 1984, 10:11038 (R;US)

Anderson, W.E., Engineering field test of a solar cooling system, data item No. 12. Final report, Phases I, II and III, 10:11053 (R;US)

Andrews, T.K. Jr., *See* Frazier, M.E., 10:11694

Angelini, P., *See* McHargue, C.J., 10:11388

Angwin, M.J., Workshop proceedings: pitting in steam generator tubing, 10:11095 (R;US)

Ankenbrandt, C., *See* Simpson, J., 10:11536

Anselmo, A., Space-charge wave propagation in inhomogeneous waveguides, 10:11535 (J;US)

Ansermet, J., *See* Rudaz, S.L., 10:11418

Antonsen T.M. Jr., *See* Ott, E., 10:11923

Appleby, A.J., Acid fuel cell technology: an overview, 10:11228 (RA;US)

Appleton, B.R., *See* McHargue, C.J., 10:11388

Araujo, G., *See* Morsi, B.I., 10:10912

Arave, A.E., Primary coolant pump measurement for ICC trend analysis, 10:11093 (R;US)

Ard, W.B., *See* Uckan, N.A., 10:11982

Arenaz, P., Lack of induction of single-strand breaks in mammalian cells by sodium azide and its proximal mutagen, 10:11698 (J;NL)

Arendt, R.H., *See* Baumgartner, C.E., 10:11278

Arey, D., Critical points in the coal fuel cycle: continued modeling analysis, 10:10931 (RA;US)

Argon, A.S., Creep crack growth in ductile alloys, 10:11332 (R;US)

Armbruster, P., Discovery of element 108 - the island of α-active nuclei beyond element 105, 10:11884 (R;DE)

Arnold, P.C., Dense phase pneumatic conveying of pulverised coal, 10:10918 (R;AU)

Arnold, W.D., *See* Kelmers, A.D., 10:11001

Aronson, A.L., BEAGL-01: a computer code for calculating rapid LWR core transients. Volume 2. User's manual, 10:11160 (R;US)

Aronson, E., *See* Stern, P.C., 10:11183

Arora, O.P., *See* Rustagi, R.S., 10:11111

Arvizu, D.E., Development of the Sandia 200X experimental silicon module, 10:11030 (RA;US)

Ashby, C.I.H., *See* Brice, D.K., 10:11782

Ashford, V., *See* Williams, S., 10:11570

Aslani, S., *See* Sincovec, R.F., 10:12018

Assmann, H., Statistical methods in the quality control of UO_2 pellets and Zircaloy cladding tubes for water-reactor fuel rods, 10:11081 (RA;DE)

Atkinson, S.A., *See* Hanson, G.H., 10:11132

Atwood, C.L., Estimating common cause failure rates for pumps in nuclear reactors, 10:11076 (R;US)
Averback, R.S., *See* Kim, S., 10:11416
Avignone, F.T. III, *See* Brodzinski, R.L., 10:11566
Axe, J.D., Neutron scattering study of the pressure-induced phase transformation in ReO_3, 10:11395 (J;US)
Azevedo, L.J., Electronic properties of new organic conductors, 10:11411 (R;US)
See Kwak, J.F., 10:11915

B

Baca, A.G., Electron energy loss spectroscopy of H_2S adsorbed on Ni(100), 10:11451 (J;US)
Badtke, D.H., *See* Aihara, H., 10:11830
Baer, D.R., *See* Jones, R.H., 10:11346
Bailey, D.S., *See* Estabrook, K., 10:11952
Bailey, V.L., *See* Schlitt, L.G., 10:11528
Bailiff, E.G., *See* Popp, R.A., 10:11691
Bairiot, H., *See* Deramaix, P., 10:11087
Bajura, R.A., *See* Zeh, C.M., 10:11247
Baker, C.C., *See* Stacey, W.M., 10:11989
Baker, D.N., *See* Feldman, W.C., 10:11755
See Gosling, J.T., 10:11756
See Hones E.W. Jr., 10:11752
See Scholer, M., 10:11751
Baker, D.R., *See* Parks, P.B., 10:11960
Baker, J.W., Electrostatic precipitation research part A: electrical properties, 10:10845 (R;AU)
Bakken, J.A., *See* Aihara, H., 10:11830
Baksay, L.A., Multichannel random pulse counter, 10:11578 (J;GB)
Balaramamoorthy, K., Experiences in the application of quality control and quality assurance programmes in water reactor fuel fabrication, 10:11110 (RA;DE)
Questions/problems of QA/QC personnel training and qualification in developing countries, 10:11112 (RA;DE)
Baldo, P., *See* Kim, S., 10:11416
Ballinger, M.Y., *See* Sutter, S.L., 10:11612
Balluffi, R.W., *See* Park, J.Y., 10:11374
Bame, S.J., *See* Feldman, W.C., 10:11755
See Gosling, J.T., 10:11756
See Hones E.W. Jr., 10:11752
See Smith, E.J., 10:11754
See Tsurutani, B.T., 10:11758
Bandy, R., Mechanisms of stress corrosion cracking and intergranular attack in Alloy 600 in high temperature caustic and pure water, 10:11327 (R;US)
Bandyopadhyay, A.K., *See* Balaramamoorthy, K., 10:11110
Barbaro-Galtieri, A., *See* Aihara, H., 10:11830
Bard, F.E., *See* Slagle, O.D., 10:11128
Bardos, J., *See* Vesely, P., 10:11135
Barkas, W.H. II, Wood power: experiments with a home-made wood gas generator system, 1982-1984, 10:11015 (R;US)
Barlow, D.B., *See* Glass, G., 10:11829
Barner, J.O., *See* Daniel, J.L., 10:10980
Barnes, A.V., *See* Aihara, H., 10:11830
Barnett, B.A., *See* Aihara, H., 10:11830
Barr, S., *See* Fowler, M.M., 10:11604
Bars, I., *See* Albright, C.H., 10:11840
Bartel, W., Charged Dsup(*) production in e^+e^- annihilation, 10:11817 (R;DE)
Measurements of energy correlations in $e^+e^- \rightarrow$ hadrons, 10:11814 (R;DE)
Barton, W.D., *See* Petrich, C.H., 10:11197
Bassham, J.A., *See* Kanazawa, T., 10:11695
Batlogg, B., *See* Axe, J.D., 10:11395
Batson, P.E., *See* Pennycook, S.J., 10:11407
Baty, G.B., First-year's operation of a full-scale second-generation FBC in an industrial plant, 10:10921 (R;US)
Baumann, D., *See* Arey, D., 10:10931
Baumann, R., *See* Wachtendonk, H.J. von, 10:11005
Baumgardner, D.R., *See* Chance, W.W., 10:11201
Baumgartner, C.E., Molten carbonate fuel cell cathode materials study, 10:11278 (J;US)
Baumjohann, W., *See* Scholer, M., 10:11751
Bauschlicher C.W. Jr., *See* Huo, W.M., 10:11452
Beasley, C.O., Effect of Coulomb collisions on universal mode stability, 10:11954 (J;US)
Becher, P.F., *See* Williams, R.K., 10:11397
Beck, F., *See* Spangenberger, H., 10:11891
Becker, G., Analysis of local transport in neutral-beam-heated L and H plasmas of ASDEX, 10:11933 (R;DE)
Becker, L., *See* Bartel, W., 10:11814, 10:11817
Becker, U., *See* Lindle, D.W., 10:11789
Beckmann, R., *See* Dersch, G., 10:11873
Bedford, A., Theories of immiscible and structured mixtures, 10:11911 (J;GB)
Beer, J.M., Combustion characteristics of synthetic liquid fuels. Quarterly technical progress report,January 1-March 31, 1982, 10:11013 (R;US)
Beery, J., *See* Mathez, E.A., 10:11721
Beevers, H., *See* Alpi, A., 10:11696
See Shimomura, S., 10:11644, 10:11645
Beezley, R.S., Electromagnetic inverse problem for dispersive media, 10:11861 (J;US)
Beg, M.A.B., Technical progress report, November 1, 1983-October 31, 1984, 10:11839 (R;US)
Behrend, H.J., Search for heavy quarks in e^+e^- collisions up to 46.78 GeV C.M. energy, 10:11815 (R;DE)
Bekowies, P.J., *See* Case, G.D., 10:10867
Bell, J.C., Evaluation of slope stability and foundation suitability for four southwestern Virginia mine spoils, 10:10875 (RA;US)
Bell, J.D., Measurement of chisub(e) in ISX-B beam-heated discharges by heat pulse propagation, 10:11965 (J;AT)
Bellman, R., Vibrational control of systems with Arrhenius dynamics, 10:12023 (J;US)
Bender, C.M., Gauge invariance and the finite-element solution of the Schwinger model, 10:11855 (J;US)
Bender, M.A., *See* Kale, R., 10:11683
Benditt, E.P., *See* Das, S.K., 10:11692
Beneden, J. van, *See* Nury, J.C., 10:11126
Benjamin, S.A., CSU-FDA (Colorado State Univ.-Food and Drug Administration) Collaborative Radiological Health Laboratory. Annual report - 1982: health effects of prenatal and postnatal whole-body exposure to ionizing radiation in the beagle dog, 10:11675 (R;US)
Benjamini, Y., *See* Bloomfield, P., 10:10934
Bennett, A.J.R., Coal cleaning by flotation, 10:10917 (R;AU)
Bennish, A.H., *See* Welch, D.R., 10:11956
Beno, M.A., *See* Kwak, J.F., 10:11915
Benson, J.M., *See* Zamora, P.O., 10:11697
Bentley, J., *See* Coyle, D.E., 10:11801
See Dhere, A.G., 10:11439
Bentsman, J., *See* Bellman, R., 10:12023
Berg, D., *See* Collick, B., 10:11831
Bergen, A.R., Structure preserving model for power system stability analysis, 10:11073 (J;US)
Berk, H.L., *See* Spong, D.A., 10:11963
Berkner, K.H., *See* Tanis, J.A., 10:11781
Berkowitz, J., Bonding and ionization energies of N—F and P—F compounds, 10:11450 (J;US)
Berman, R.H., Simulation of phase space hole growth and the development of intermittent plasma turbulence, 10:11951 (J;US)
Berman, S., *See* Clear, R., 10:11289
Bernard, S.R., *See* Sobel, M., 10:11667
Bernhard, W.A., Use of alpha hyperfine coupling tensors as a measure of unpaired spin density and free radical geometry, 10:11783 (J;US)
Bernhardi, K., *See* Becker, G., 10:11933
Bernstein, E.M., *See* Tanis, J.A., 10:11781
Bernstein, S., *See* Case, G.D., 10:10867
Berry, H.A., Status of the Graphic Overview System in relation to Department of Energy facilities, 10:11622 (R;US)
Berry, L.A., *See* Uckan, N.A., 10:11981
Besen, M., *See* Greenwald, M., 10:11976
Besmann, T.M., Thermochemical modeling of the plutonium and uranium-plutonium dioxides, 10:11440 (R;US)
Betzer, P.R., Methane and fertilizer production from seaweed biomass. Final report, 10:11017 (R;US)
Bharvani, R., Techno-economic evaluation of a direct fuel cell system, 10:11234 (RA;US)
Bhatia, T.S., *See* Glass, G., 10:11829
Bieber, A.M. Jr., Bar code instrumentation for nuclear safeguards, 10:11004 (R;US)
Biefeld, R.M., *See* Chaffin, R.J., 10:11031
Biegelsen, D.K., Structural and electronic properties of amorphous-silicon-based alloy materials. Final report, June 1983-May 1984, 10:11037 (R;US)
Bier, R., *See* Jory, H., 10:11973
Biermann, U., *See* Comminchau, V., 10:11559
Biermann, W.J., *See* Reimann, R.C., 10:11051, 10:11052
Biggerstaff, J.A., *See* Milner, W.T., 10:12009
Bilello, J.C., Research consortium for x-ray topography on line X-19 at NSLS. Technical progress report, June 1-December 1, 1984, 10:11334 (R;US)
Biljetina, R., *See* Chynoweth, D.P., 10:11012
Binnie, D.M., TASSO vertex detector, 10:11557 (R;DE)

Binns, W.O., Acid rain and forestry, 10:11591 (R;GB)
Bionta, R.M., *See* Park, H.S., 10:11828
Bird, F., *See* Williams, S., 10:11570
Birdsall, B., *See* Curtis, R.B., 10:11290
Birgeneau, R.J., *See* Allen, J., 10:11732
Birn, J., *See* Feldman, W.C., 10:11755
See Hones E.W. Jr., 10:11752
Birx, D.L., *See* Schlitt, L.G., 10:11528
Bjorklund, W.J., *See* Scharnhorst, N.L., 10:10985
Blacic, J.D., *See* Kranz, R.L., 10:10996
See Mathez, E.A., 10:11721
Blake, J.B., *See* Chenette, D.L., 10:11734
Blann, M., Precompound limits of linear momentum transfer in heavy ion reactions, 10:11874 (J;US)
Blanton, J.O., Nearshore transport processes affecting the dilution and fate of energy-related contaminants. Progress report, June 1, 1981-November 30, 1984, 10:11729 (R;US)
Blazek, C., *See* Daniels, E., 10:11178
Bleckmann, I., Incubation time and cracking pattern in transcrystalline stress corrosion of austenitic chromium-nickel steels in magnesium chloride solutions, 10:11386 (TJ;GB)
Blewitt, G., *See* Park, H.S., 10:11828
Bloch, A.J., Effects of oil deregulation on public transportation. Final report, 10:11213 (R;US)
Block, D.L., Thermoeconomic optimizarion of OC-OTEC electricity and water production plants. Final report, 10:11050 (R;US)
Bloom, E.E., *See* Conn, R.W., 10:11993
Bloomfield, P., Volume and area of oil fields and their impact on order of discovery, 10:10934 (R;US)
Blose, R.L., *See* Gronager, J.E., 10:11173
Blumenfeld, B.J., *See* Aihara, H., 10:11830
Boatner, L.A., *See* Sales, B.C., 10:10995
Bobbett, R.E., *See* Srinivasan, S., 10:11262
Boekema, C., Magnetic interactions, bonding, and motion of positive muons in magnetite, 10:11394 (J;US)
Boercker, D.B., Static and dynamic shifts of spectral lines, 10:11796 (J;US)
Boissevain, J.G.J., *See* Glass, G., 10:11829
Bokemeyer, H., Positron spectroscopy of supercritical heavy ion collision systems, 10:11767 (R;DE)
Boles, P.H., Shrub cover and density on western rangelands in relation to reclamation standards for surface mined lands in Wyoming, 10:10873 (RA;US)
Boley, D., Modified Method for Reconstructing periodic Jacobi matrices, 10:12022 (J;US)
Bolt, S.E., *See* Cheverton, R.D., 10:11149
Bondietti, E.A., *See* Garten, C.T. Jr., 10:11619
Bonduelle, F., *See* Legendre, E., 10:11312
Bone, K.M., Trace elements in brown coal and its combustion products, 10:10878 (R;AU)
Bora, D., *See* Snipes, J.A., 10:11931
Borderie, B., *See* Jacquet, D., 10:11886
Boudrie, R.L., *See* Ullmann, J.L., 10:11878
Boughner, R.E., *See* Rinsland, C.P., 10:11589
Bourcier, R., *See* Stout, M.G., 10:11367
Bourg, J., *See* Cabrera, B., 10:11490
Bowdery, C., *See* Bartel, W., 10:11814, 10:11817
Bower, W.I., Photovoltaic power-conditioning performance evaluation, lessons learned, 10:11045 (RA;US)
Bowersox, D.F., Assay of plutonium metal by gamma spectrometry and calorimetry, 10:11430 (R;US)
Bowles, K., Methods and procedures of chemical analyses of zircaloy tubing, 10:11127 (RA;DE)
Bowsher, C.A., Management weaknesses affect Nuclear Regulatory Commission efforts to address safety issues common to nuclear power plants, 10:11115 (R;US)
Status of civilian federal agencies' efforts to address hazardous waste problems on their lands, 10:11187 (R;US)
Boyce, J.B., *See* Biegelsen, D.K., 10:11037
Boyd, M.R., *See* Haschek, W.M., 10:11708
Boyns, P.K., *See* Jobst, J.E., 10:11620
Bozzolo, G., Dynamical basis generation method with an application to the four-nucleon problem, 10:11894 (J;US)
Brabers, V.A.M., *See* Boekema, C., 10:11394
Bradburn, D.M., Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 6, Appendix F: forest management, 10:11196 (R;US)
Bradley, D.R., *See* Copus, E.R., 10:11171
See Gronager, J.E., 10:11173
Bradley, R.A., Surface Gasification Materials Program. Semiannual progress report for the period ending September 30, 1984, 10:10848 (R;US)
Brafman, H., SLAC Scanner Processor: a FASTBUS module for data collection and processing, 10:11554 (R;US)
Brager, H.R., *See* Garner, F.A., 10:11336
Bragg, R.H., *See* Mehrotra, B.N., 10:11425
Brand, M.J., Fuel cell power system for forklift trucks, 10:11258 (RA;US)
Brandshaug, T., Application of far-field models to the disposal of nuclear waste in geologic formations, 10:10991 (R;US)
Brandt, R., *See* Dersch, G., 10:11873
Bratton, C.B., *See* Park, H.S., 10:11828
Brau, K., *See* Sevillano, E., 10:11930
Braunschweig, W., *See* Althoff, M., 10:11818
Breault, R.D., Phosphoric acid electric utility fuel cell technology development. Technical progress report No. 16, August 1984, 10:11275 (R;US)
Phosphoric and electric utility fuel cell technology development. Technical progress report No. 18, October 1984, 10:11277 (R;US)
Breitung, W., Significance of cesium in LMFBR and LWR safety analysis, 10:11164 (R;DE)
Brenner, D.J., *See* Zaider, M., 10:11472, 10:11677
Bretscher, M.M., Blackness coefficients, effective diffusion parameters, and control rod worths for thermal reactors - methods, 10:11129 (R;US)
Brewbaker, J.L., Biomass energy options for the American Territories of the Pacific, 10:11223 (R;US)
Brice, D.K., Electron bombardment enhancement of the reactivity of graphite with atomic hydrogen: Threshold-like effects, 10:11782 (J;US)
Briggs, D., SLAC Mark II upgrade drift chamber front end electronics, 10:11569 (R;US)
Briggs, T.A., *See* Breault, R.D., 10:11275, 10:11277
Brinkley, F.W., *See* Alcouffe, R.E., 10:11899
Brock, A.J., Corrosion resistance of metallic solar absorber materials in a range of heat transfer fluids. Final technical report, 10:11055 (R;US)
Brockmann, J.E., *See* Tarbell, W.W., 10:11172
Brockway, D.J., Devolatilisation of brown coal, 10:10859 (R;AU)
Brodzinski, R.L., ^{76}Ge double beta decay experiment at Homestake, 10:11566 (R;US)
Brom J.M. Jr., *See* Linn, S.H., 10:11770
Brooks, A.L., *See* Zamora, P.O., 10:11697
Bross, A.D., *See* Aihara, H., 10:11830
Brostow, W., Prediction of solid + liquid equilibrium diagrams for binary mixtures forming solid solutions with an extremum, 10:11379 (J;US)
Broughton, J.M., Assessment of nuclear fuel rod and solid electric heater thermal behavior during the heatup and reflood phases of a large break LOCA, 10:11152 (R;US)
Brower, R.W., *See* Good, R.R., 10:11147
Brown, B., *See* Simpson, J., 10:11536
Brown, D.P., *See* Brodzinski, R.L., 10:11566
Brown, E.H. Jr., *See* Kalchthaler, R.F. Jr., 10:10871
Brown, F.B., Improved potential energy surface for $F+H_2 \rightarrow HF+H$ and $H+H'F \rightarrow HF+H'$, 10:11447 (J;US)
Brown, L.M., Government acronyms and alphabetic organizational designations used in DTIC (Defense Technical Information Center), 10:12030 (R;US)
Brown, N.A., *See* Gill, W.W., 10:10856
Brown, N.J., *See* Wirtenson, G.R., 10:11423
Brown, P.J., *See* Lander, G.H., 10:11361
Brown, R.W., Weak corrections to the e+e-yields mu+mu- asymmetry, 10:11825 (R;DE)
Brown, T.G., *See* Sager, P.H., 10:12001
Bruessermann, M., Cysts of the semilunar cartilage. Pathogenesis, clinical symptoms and radiology considering also pneumo-arthrographic findings, 10:11653 (R;DE;In German)
Bryan, G.H., *See* Scharnhorst, N.L., 10:10985
Bryan, W.E., *See* Uckan, N.A., 10:11981
Bryant, E.A., *See* Wolfsberg, K., 10:11740
Bubernak, J., *See* Matlack, G.M., 10:11432
Buchanan, C.D., *See* Aihara, H., 10:11830
Buchanan, W., Integrated energy systems for buildings, 10:11231 (RA;US)
Buckingham, M.J., Cryogenic gravity gradiometer for geophysical exploration, 10:10889 (R;AU)
Buelt, J.L., Innovative electrical technique for in-place stabilization of contaminated soils, 10:10979 (R;US)
Buenerd, M., *See* DiGiacomo, N.J., 10:11870
Buerger, J., *See* Behrend, H.J., 10:11815
Buescher, B.J., *See* Osetek, D.J., 10:11145
Buhl, W.F., *See* Curtis, R.B., 10:11290
Buken, G., *See* Rauscher, R., 10:11106
Bume, S.J., *See* Scarf, F.L., 10:11753

Burchat, P., *See* Briggs, D., 10:11569
Burchat, P.R., New drift chamber for the Mark II detector at the SLAC Linear Collider, 10:11568 (R;US)
Burdon, R.G., Improved recovery of fine coal, 10:10916 (R;AU)
Burgess, E.L., Operation and maintenance experience at intermediate-sized photovoltaic projects, 10:11046 (RA;US)
Burgess, E.T., *See* Kershner, C.J., 10:11497
Burgett, M., *See* Rogers, L.E., 10:11670
Burke, G.J., Surface wave excitation study, 10:11521 (R;US)
Burke, L.O., *See* Cudmore, J.F., 10:10846
Burke, R.P., Regulatory analyses for severe accident issues: an example, 10:11170 (R;US)
Burolla, V.P., *See* Hruby, J.M., 10:11059
Burrell, C.F., Laser-induced fluorescence of metal-atom impurities in a neutral beam, 10:11935 (R;US)
Burson, Z.G., *See* Lackey, J.G., 10:11624
Burton, G.W., *See* Hanna, W.W., 10:11668
Busch, G.E., *See* Rosen, M.D., 10:11498
Buschbom, R.L., *See* Loscutoff, S.M., 10:10933
Buskirk, F.R., Time development of Cherenkov Radiation. Technical report, 10:11896 (R;US)
See Neighbours, J.R., 10:11897
Bustamante, H., *See* Bennett, A.J.R., 10:10917
Butler, M.A., Photoelectrochemical imaging, 10:11577 (J;US)
Butner, R.S., *See* Sealock, L.J. Jr., 10:10843
Butz, T.R., Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 8, Appendix H: geology, 10:11198 (R;US)

C

Cabrera, B., Report on Stanford superconductive monopole detectors, 10:11490 (BA;US)
Cacuci, D.G., Efficient estimation of feedback effects with application to climate models, 10:11602 (J;US)
Cadwell, L.L., *See* Cline, J.F., 10:11621
See Klepper, E.L., 10:11665
Cadzow, J.A., Parametric coherence estimation via convolved correlations, 10:11928 (R;US)
Calarco, J.R., *See* Griffioen, K.A., 10:11885
Callahan, C.A., *See* Thomas, J.M., 10:11618
Callen, J.D., *See* Bell, J.D., 10:11965
Camacho, F., *See* Greenwald, M., 10:11976
Camara, E.H., Molten carbonate fuel cell component development, 10:11238 (RA;US)
Cameron, W., *See* Binnie, D.M., 10:11557
Campbell, A.J., *See* Binnie, D.M., 10:11557
Campbell, C.T., *See* Srinivasan, S., 10:11262
Campbell, D.K., Soliton energetics in extended Peierls-Hubbard models: a quantum Monte Carlo study, 10:11906 (R;US)
Campbell, D.O., Chemical behavior of fission product iodine following LWR accidents, 10:11143 (R;US)
Campbell, E.M., *See* Matthews, D.L., 10:11499
See Rosen, M.D., 10:11498
Campbell, R.J., *See* Canada, D.C., 10:11429
Campbell, R.M., *See* Thomas, V.W., 10:11637
Camporesi, T., *See* Fernandez, E., 10:11827
Canada, D.C., Isotopic analysis of enriched/depleted SO_2 via low-resolution mass sectrometry, 10:11429 (R;US)
Cannon, J.B., *See* Pin, F.G., 10:11002
Capjack, C.E., *See* Marchand, R., 10:11984
Carli, W., *See* Ziegler, N.F., 10:11530
Carlson, K.E., Mechanistic accumulator model for light water reactor transient analysis, 10:11154 (R;US)
Carney, J.H., *See* O'Neill, R.V., 10:11634
Carpenter, A.R., Rail coal transportation under the Staggers Act, 10:11214 (R;US)
Carpenter, J.G., *See* Meechan, P.J., 10:11678
Carpenter, R.W., *See* Lowndes, D.H., 10:11406
Carr, B.J., Origin of cosmological density fluctuations, 10:11739 (R;US)
Carrano, A.V., *See* Dillehay, L.E., 10:11646
Carreras, B.A., *See* Holmes, J.A., 10:11953
Carroll, M.C., An analysis of bremsstrahlung energy deposition in magnetic fusion first wall materials, 10:11994 (J;US)
Carroll, T.O., Transportation/energy analysis: principles and practice, 10:11300 (RA;US)
Carruthers, J., Mine roadway stabilisation, 10:10896 (R;AU)
Carter, G.W., *See* Trusty, R.M., 10:11488
Carter, N.L., Deformation of granitic rocks at elevated temperatures and pressures. Interim report, 1 March-15 December 1984, 10:11724 (R;US)
Carubelli, A., *See* Srinivasan, S., 10:11262
Case, G.D., Evaluation of particulate collection devices developed for pressurized fluidized-bed combustors as applied to coal gasification processes, 10:10867 (R;US)
Case, G.N., *See* McDowell, W.J., 10:11433
Casper, D., *See* Park, H.S., 10:11828
Cassing, W., Mean-field dynamics versus two-body collisions at intermediate energy heavy-ion reactions, 10:11890 (R;DE)
Casten, R.F., Nuclear dynamical supersymmetry, 10:11895 (J;US)
Castle, R.N., *See* Lee, M.L., 10:10850
See Pelroy, R.A., 10:11702
Castleman, A.W. Jr., Neutral and charged clusters in the atmosphere: their importance and potential role in heterogeneous catalysis, 10:11455 (J;US)
Castorina, P., QCD chiral-symmetry breaking in a Rayleigh-Ritz variational calculation, 10:11856 (J;US)
Cavanagh, R.R., *See* King, D.S., 10:11445
Cecil, F.E., *See* Medley, S.S., 10:11943
Ceglio, N.M., *See* Matthews, D.L., 10:11499
Cess, R.D., *See* Potter, G.L., 10:11601
Chaffin, R.J., Strained superlattice, quantum well, multijunction photovoltaic cell, 10:11031 (RA;US)
Chalkin, P.M., *See* Lince, J.R., 10:11324
Chan, M.K.W., *See* Farnsworth, R.K., 10:10984
Chan, T.F., Existence and Computation of LU-factorization with small pivots, 10:12020 (J;US)
Chance, W.W., Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 11, Appendix K: site development, 10:11201 (R;US)
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 17. Maps, 10:11207 (R;US)
Chandlee, C., *See* Collick, B., 10:11831
Chanowitz, M.S., Resonances in photon-photon scattering, 10:11842 (R;US)
Charatis, G., *See* Rosen, M.D., 10:11498
Chen, C.H., *See* Hurst, G.S., 10:11736
Chen, D.M., Positron reemission: measurement of thin single crystal W(100) films to be used as transmission moderator or re-moderators, 10:11761 (R;US)
Chen, H.L., Study of desulfurization by high-temperature leaching with chemical addition, 10:10833 (RA;US)
Chen, J.W., Extraction and desulfurization of chemically degraded coal with supercritical fluids, 10:10832 (RA;US)
See Schneiderman, S., 10:10852
Chen, S., *See* Morsi, B.I., 10:10912
Chen, T.P., *See* Noer, R.J., 10:11420
Chen, Y., Diffusion of deuterium and hydrogen in rutile TiO_2 crystals at low temperatures, 10:11398 (J;US)
Chenette, D.L., Charge-state composition of 0.4-MeV helium ions in earth's outer radiation belts during quiet times. Technical report, 10:11734 (R;US)
Cheng, W.K., *See* Beer, J.M., 10:11013
Chess, E.K., Process-related effects on chemical composition of direct coal liquefaction materials, 10:10862 (R;US)
See Later, D.W., 10:10861
Chester, C.V., *See* Zimmerman, G.P., 10:11581
Cheverton, R.D., Experimental verification of the behavior of surface flaws in thick-walled steel cylinders during severe thermal shock, 10:11149 (R;US)
Chiang, C.J., *See* King, D.L., 10:11034
Chiang, S.H., *See* Morsi, B.I., 10:10912
Chiang, T.C., *See* Miller, T., 10:11375
Child, C.A., Gasification of residual materials from coal liquefaction. Final report, 10:10830 (R;US)
Chiles, M.M., *See* Turner, J.E., 10:11903
Choi, C., *See* Miley, G., 10:11997
Chowdhury, D.P., Application of photon correlation spectroscopy to flowing Brownian motion systems, 10:11807 (J;US)
Christian, S.D., *See* Scamehorn, J.F., 10:11427
Christophorou, L.G., *See* Faidas, H., 10:11467
See Spyrou, S.M., 10:11773

Chrysicopoulou, P., *See* Park, H.S., 10:11828
Chughtai, M.Y., Re-heating flue gases from flue gas cleaning plants by means of heat exchangers, 10:10876 (TJ;GB)
Chynoweth, D.P., Biogasification products of water hyacinth wastewater reclamation, 10:11012 (R;US)
Cianetti, C., Kinetics and mechanism of the interfacial mass transfer of Zn^{2+}, Co^{2+} and Ni^{2+} in the system: bis(2-ethylhexyl)phosphoric acid, n-dodecane - KNO_3, water, 10:11434 (J;US)
Cihangir, S., *See* Collick, B., 10:11831
Citrin, P.H., *See* Comin, F., 10:11417
Claar, T.D., *See* Fee, D.C., 10:11226, 10:11245
Clancy, T., Testing of refractories in co-containing coal gasification atmospheres. Final report, 10:10840 (R;US)
Clapp, R.B., *See* Rothschild, E.R., 10:10978, 10:11625
Clark, D., *See* Klubek, B., 10:10834
Clark, M., *See* Tanis, J.A., 10:11781
Clark, M.L., *See* Wehner, A.P., 10:11712
Clark, P.E., *See* Rybicki, E.F., 10:10950
Clark, R.J., *See* Kelmers, A.D., 10:11001
Clark, R.M., *See* Grayman, W.M., 10:11631
Clarke, J., *See* Martinis, J.M., 10:11914
Claro, L.H., Moderization of the LEOPARD library, 10:11092 (R;BR;In Portuguese)
Claus, J., *See* Simpson, J., 10:11536
Claus, R., *See* Park, H.S., 10:11828
Clear, R., Fundamental problems with visual performance research described in the CIE 19/2 report, 10:11289 (R;US)
Clem, J.R., Zero-quantum superconducting magnetic shield, 10:11491 (BA;US)
Clements, W.E., Observations of a drainage flow event on a high-altitude simple slope, 10:11587 (J;US)
Cleveland, B.T., *See* Rowley, J.K., 10:11735
Cliff, D.I., Formation of nitrogen oxides from the combustion of Yallourn brown coal, 10:10927 (R;AU)
Clinard, F.W. Jr., *See* Scott, J.L., 10:11974
See Whitley, J.B., 10:11988
Cline, J.F., Relationship between burial depth and radiocesium and radiostrontium and their accumulation in crop plants, 10:11621 (R;US)
See Thomas, J.M., 10:11618
Clough, S.P., *See* Hintz, M.B., 10:11380
Clover, M.R., *See* DiGiacomo, N.J., 10:11870
Coates, G.K., *See* Osnes, J.D., 10:11723
Codell, R.B., *See* Eraslan, A.H., 10:11636
Cohen, M.L., *See* Northrup, J.E., 10:11800
Coin, C.D.A., *See* Gill, W.W., 10:10856
Cole, D., *See* Medley, S.S., 10:11943
Cole, F.I., *See* Hoenig, S.A., 10:11024
Coleman, A.J., *See* Adams, A.A., 10:11259
Colestock, P., *See* Skiff, F., 10:11945
Collick, B., Primakoff production of the $B^+(1235)$ meson, 10:11831 (J;US)
Collins, J.L., Behavior of Cs, I, and Te in the fission product release program at ORNL, 10:11157 (R;US)
Colombo, L., *See* Kataoka, T., 10:11426
Combs, S.K., *See* Foster, C.A., 10:12002
Comin, F., Local atomic structure of a clean surface by surface-extended x-ray absorption fine structure: Amorphized Si, 10:11417 (J;US)
Comminchau, V., Test of a high resolution drift chamber prototype, 10:11559 (R;DE)
Commisso, R.J., Plasma switch development. Final report 26 February 1982-25 February 1984, 10:11516 (R;US)
Congdon, J.V., *See* Breault, R.D., 10:11275, 10:11277
Conkel, D., Devonian production needs stimulation, 10:10952 (J;ZZ)
Conn, A.F., Reducing/separating recoverable demolition wastes with cavitating water jets. Technical report on phase 1, 10:11309 (R;US)
Conn, R.W., Lower activation materials and magnetic fusion reactors, 10:11993 (J;US)
See Stacey, W.M., 10:11989
Conner, J.G., *See* Litt, R.D., 10:10920
Connor, J.W., Finite-Larmor-radius modification of the Mercier criterion, 10:11969 (J;AT)
Conway, M.A., *See* Medley, S.S., 10:11943
Conway de Macario, E., *See* Macario, A.J.L., 10:11662
Cook, B.A., *See* Osetek, D.J., 10:11145
Cook, D.H., Calculation of thermal mixing for the BWR Mark I containment pressure suppression pool, 10:11158 (R;US)
Cook, G.M., Development of aqueous batteries for electric vehicles. Summary report, October 1981-December 1983, 10:11318 (R;US)
Cook, J.W. Jr., *See* Lucovsky, G., 10:11036
Cook, L.M., *See* Wirtenson, G.R., 10:11423
Cooke, D.W., *See* Boekema, C., 10:11394
Cooke, R.H., Radiological safety at Argonne National Laboratory's heavy ion research facility, 10:11542 (R;US)
Cool, R.L., Experimental studies of elementary particle interactions at high energies. Technical progress report, 10:11822 (R;US)
Cooper, A.R., Coupled diffusion phenomena. Final report, 10:11392 (R;US)
Cooper, J., *See* Simpson, J., 10:11536
Cooper, L., *See* Krupp, W.E., 10:11114
Cooper, P.K., Inducible excision repair in Escherichia coli, 10:11685 (BA;US)
Cooper, R.E., *See* Pepper, D.W., 10:11511
Coppola, C., Quality techniques implemented during the fabrication phase of additivates and barrier fuel pellets and bundles, 10:11102 (RA;DE)
Technical and administrative implementation of QA and QC during fabrication of additivated and barrier fuel pellets, 10:10960 (RA;DE)
Copus, E.R., Interaction of hot solid, core debris with concrete, 10:11171 (R;US)
Corbett, B.L., Bulk Shielding Facility quarterly report, April, May and June 1984, 10:11136 (R;US)
Cordi, R.C., *See* Springer, R.W., 10:11768
Cords, D., *See* Bartel, W., 10:11814, 10:11817
Coroniti, F.V., *See* Scarf, F.L., 10:11753
Cortez, B.G., *See* Park, H.S., 10:11828
Cotanch, S.R., Theoretical nuclear reaction and structure studies using kaons and photons. Progress report, 10:11866 (R;US)
Coteus, P., Design for small angle (0 to 2mr) spectrometer for ep or anti pp collisions at DO, 10:11560 (R;US)
Counce, R.M., *See* Smith, G.V., 10:10964
Countryman, P.J., *See* Griffioen, K.A., 10:11885
Courtney, J.C., *See* Garcia, A.S., 10:11482
Cowan, G.A., *See* Wolfsberg, K., 10:11740
Cox, E., Selective permit requirements for natural resource development, land use regulation, environmental quality management, social/ecological preservation, and local regulatory policy. Volume 4. Vermont, 10:11627 (R;US)
Coyle, D.E., Energy transfer studies between Ne and H_7O, 10:11801 (J;NL)
Coyne, J.J., *See* Wilson, W.E., 10:11901
Craig, R.R., *See* Vanka, S.P., 10:11507
Cramer, S.N., KENO-V code, 10:11119 (R;US)
MORSE Monte Carlo code, 10:11120 (R;US)
Crampton, L.S.W., Environmental progress and challenges: an EPA (Environmental Protection Agency) perspective, 10:11189 (R;US)
Crawford, H., *See* Gould, H., 10:11551
Creasey, J., Prediction and monitoring of roof conditions, 10:10901 (R;AU)
Crelling, J.C., *See* Miller, D.M., 10:10851
Crenshaw, J., *See* Arey, D., 10:10931
Criegee, L., *See* Behrend, H.J., 10:11815
Cristol, S.J., Sensitization and quenching in the conversion of light energy into chemical energy. Final report, 10:11468 (R;US)
Crooker, N.U., Large scale flow in the dayside magnetosheath, 10:11750 (J;US)
Crosthwait, C.D., *See* Oakberg, E.F., 10:11705
Crouse, D.A., *See* Hanson, W.R., 10:11681
Crouse, R.S., *See* Harris, L.A., 10:11616
Crow, W.D., *See* Adler, H.I., 10:11663
Csonka, P.L., *See* Tatchyn, R., 10:11574
Cucinotta, F., *See* Wilson, J.W., 10:11904
Cudmore, J.F., Applied coal and coke petrography, 10:10860 (R;AU)
Carbonising properties of Australian coals and blends, 10:10846 (R;AU)
Culbertson, R.J., *See* Pennycook, S.J., 10:11407
Cunha Menezes Filho, A. da, *See* Claro, L.H., 10:11092
Curtis, R.B., DOE-2 Building Energy Analysis Program, 10:11290 (R;US)
Technological and economic issues in building energy use, 10:11285 (RA;US)
Curtis, W.P., *See* Moody, C.E. Jr., 10:11182
Cushman, R.M., *See* Giddings, J.M., 10:10887
Cutshall, N.H., *See* Kelmers, A.D., 10:11001

D

Da Hsuan Feng, *See* Casten, R.F., 10:11895

Dagle, G.E., *See* Wehner, A.P., 10:11712

Dahl, A.R., *See* Zamora, P.O., 10:11697

Dalbey, W., *See* Lock, S., 10:11687

Dalbey, W.E., *See* Hakkinen, P.J., 10:11693

Dale, J.M, *See* Rosseel, T.M., 10:11762

Dana, M.T., OSCAR experiment high-density network data report: Event 4 - April 21-23, 1981, 10:11593 (R;US)
See Rothert, J.E., 10:11594

Danesi, P.R., *See* Cianetti, C., 10:11434

Daniel, J.L., Reference and testing materials available from the Materials Characterization Center, 10:10980 (R;US)

Danielewicz, P., Dissipative phenomena in quark-gluon plasmas, 10:11848 (J;US)

Daniels, E., High temperature gas reactor and energy pipeline system, 10:11178 (J;ZZ)

Daniels, K.L., Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 5, Appendix E: environmental monitoring, 10:11195 (R;US)

Daniels, K.S., *See* Wolfsberg, K., 10:11740

Danielson, M.J., *See* Jones, R.H., 10:11346

Das, M., *See* Rustagi, R.S., 10:11111

Das, S.K., Rapid changes in deoxynucleoside triphosphate pools in mammalian cells treated with mutagens, 10:11692 (J;US)

Daugherty, R.O., Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 14, Appendix O: utilities, 10:11204 (R;US)

Davidson, D.L., *See* Schulson, E.M., 10:11369

Davidson, R.D., *See* Tapping, R.L., 10:11007

Davis, J.W., *See* Conn, R.W., 10:11993

Davis, P.K., Fine particle coal as a source of energy in small user applications, 10:10923 (RA;US)
Hydrocylcone system for recovery of low-sulfur coal fines from gob, 10:10907 (RA;US)

Davis, R. Jr., *See* Rowley, J.K., 10:11735

Dawson, J.W., Data preprocessor and compactor for the Soudan 2 nucleon decay experiment, 10:11558 (R;US)

Dawson, L.R., *See* Chaffin, R.J., 10:11031
See Schirber, J.E., 10:11415

Day, L.E., 1983 environmental monitoring report, 10:11607 (R;US)

Dayananda, M.A., Analysis of concentration profiles for fluxes, diffusion depths, and zero-flux planes in multicomponent diffusion, 10:11368 (J;US)

Daywitt, W.C., Coaxial noise standard for the 1 GHz to 12.4 GHz frequency range. Final report, 10:11487 (R;US)

De Angelis, R.J., *See* Dhere, A.G., 10:11439

De Jonghe, L.C., *See* Hu, S.C., 10:11401

De Leon, N., *See* Eaker, C.W., 10:11786

De Sangro, R., *See* Fernandez, E., 10:11827

de Visser, A., *See* Willis, J.O., 10:11357

Deacon, D.A.G., Measurement of the transverse mode excitation in the stimulated emission of the ACO free electron laser. Final report 15 September-31 December 1983, 10:11495 (R;US)

Decker, R., *See* Brown, R.W., 10:11825

Deen, J.R., Neutronics study of LEU fuel options for the HFR-Petten, 10:11133 (R;US)

Deffeyes, K.S., *See* Bloomfield, P., 10:10934

DeGrand, T., Lattice Monte Carlo calculations of finite temperature QCD, 10:11851 (R;US)

DeGrand, T.A., *See* Campbell, D.K., 10:11906

DeGroot, D.E., Eckerd College Energy Systems Project. Final technical report, 10:11287 (R;US)

Dehmer, J.L., *See* Pratt, S.T., 10:11771

Dehmer, P.M., *See* Pratt, S.T., 10:11771

DeJong, K.B., *See* Osnes, J.D., 10:11723

Delapalme, A., *See* Lander, G.H., 10:11361

Demacario, E.C., Methane producing bacteria: immunological characterization. Final Report, 1 April 1981-31 March 1984, 10:11661 (R;US)

Demmie, P.N., Ability of the TRAC-P1A computer program to predict blowdown, refill, and reflood phenomena during Semiscale Mod-1 experiments, 10:11153 (R;US)

Denais, J.D., *See* Sheibley, D.W., 10:11256

Denholm, W.T., Coal firing of the Sirosmelt reactors, 10:10926 (R;AU)

Denison, A.B., *See* Boekema, C., 10:11394

Deramaix, P., Performance-related characteristics of water reactor fuel - an update, 10:11087 (RA;DE)

Deringer, J.J., Energy for sales, 10:11299 (J;US)
See Misuriello, H., 10:11296, 10:11298
See Misuriello, H.P., 10:11295, 10:11297

Dernbach, B., Experimental investigation of the performance of pressurizer safety valves during single- and two-phase flow (ATWS). Final report, 10:11163 (R;DE;In German)

Derouin, C.R., *See* Srinivasan, S., 10:11262

Derrick, M., Report of the Snowmass hadronization group, 10:11833 (R;US)

Dersch, G., Unusual behavior of projectile fragments formed in the bombardment of copper with relativistic Ar ions, 10:11873 (R;US)

Deslattes, R.D., Applications of new absolute measurements of x-rays and gamma-rays. Final report, 10:11565 (R;US)
Impact of atomic physics on fundamental constants. Final report, 10:11769 (R;US)

Deuber, H., Parametric investigations on the retention of methyl iodide by a KI-impregnated activated carbon, 10:11124 (R;DE;In German)

Deutschmann, M., *See* Comminchau, V., 10:11559

Devoret, M.H., *See* Martinis, J.M., 10:11914

DeVries, R.M., *See* DiGiacomo, N.J., 10:11870

Dhere, A.G., Characterization of supported metal catalysts by imaging, microdiffraction and microanalysis techniques, 10:11439 (R;US)

Di Gregorio, S., *See* Axe, J.D., 10:11395

Diament, H., *See* Eraslan, A.H., 10:11636

Diamond, D.J., RAMONA-3B, a code for BWR plant transients, 10:11138 (R;US)
See Aronson, A.L., 10:11160

Diamond, P.H., *See* Holmes, J.A., 10:11953

Dickens, P.S., Chemical quality of the saturated zone associated with contour surface mining spoil and its effect on stream water quality, 10:10883 (RA;US)
Hydrologic characterization of the saturated zone associated with contour surface mining spoil in the New River Basin of Tennessee, 10:10881 (RA;US)

Dickerman, J.C., *See* Mobley, J.D., 10:11527

Diebold, R., Physics at 10^{34} cm^{-2} s^{-1}, 10:11813 (R;US)
pp Interaction Regions, 10:11537 (R;US)
Super-collider: progress, options and physics, 10:11529 (R;US)

Diedrich, R., *See* Gielecki, M., 10:11074

Dieker, J.L., *See* Wolcott, D.R., 10:11221

Diel, B.N., Conversion of allylphosphine to novel diphosphines: synthesis and characterization of $CH_2{=}CHCH_2P(H)(CH_2)_3PH_2$ and $P[(CH_2)_3]^3P$, 10:11471 (J;GB)

Dierker, J.L., *See* Wolcott, D.R., 10:11220

Diestler, D.J., *See* Riley, M.E., 10:11784

Diggs, J.M., Breeder Spent Fuel Handling (BSFH) cask study for FY83. Final report, 10:10966 (R;US)

DiGiacomo, N.J., Inclusive pion production in 330, 400, and 500 MeV proton-nucleus collisions, 10:11870 (J;US)

Dillehay, L.E., Relationship between sister-chromatid exchange and perturbations in DNA replication in mutant EM9 and normal CHO cells, 10:11646 (J;NL)

Dils, R.R., Hot wire thermal conductivity measurements in high temperature refractories, 10:11391 (R;US)

Dines, K.A., Computerized underground image reconstruction. Progress report, July 15, 1982-April 15, 1983, 10:11483 (R;US)

Dinger, J.S., *See* Kipp, J.A., 10:10904

Dingerson, M.R., Mining research and development program. Second quarterly report, June 25, 1982-September 25, 1982, 10:10894 (R;US)

Dini, J.W., Use of electrodeposition to provide coatings for solid state bonding, 10:11384 (J;US)

Distefano, M., *See* Kanazawa, T., 10:11695

Dittmore, C.H., *See* Henke, B.L., 10:11575

Divadeenam, M., Least squares fit of thermal data for fissile nuclei, 10:11881 (R;US)

Dobisz, E.A., Reaction of amorphous NiNb films with crystalline metal overlayers, 10:11350 (R;US)

Dodds, H.L., *See* Easter, M.E., 10:10963

Dodson, L.A., Inducible reactivation of bacteriophage T7 damaged by methyl methanesulfonate or UV light, 10:11689 (J;US)

Doerner, R.C., *See* Meek, C.C., 10:11113

Doggett, J.N., Technology development facility (TDF), 10:11999 (BA;GB)

Doherty, T.J., *See* Allen, R.D., 10:11176

Doll, J.D., *See* Freeman, D.L., 10:11448
See Voter, A.F., 10:11446
Doolan, K.J., *See* Rigby, G.R., 10:10857
Dorfan, D., *See* Briggs, D., 10:11569
Dougan, P.M., BX In Situ Oil Shale Project. Environmental Mitigation and Monitoring Plan (revised September 1981), 10:10955 (R;US)
Dousse, J.C., *See* DiGiacomo, N.J., 10:11870
Dowell, J.L., Segregation of spent N-Reactor fuel by plutonium isotopic content, 10:10965 (R;US)
Downey, M., *See* Scaife, P.H., 10:10890
Downey, S.W., *See* Wolfsberg, K., 10:11740
Doyle, B.L., *See* Dobisz, E.A., 10:11350
Draheim, K.J., *See* Comminchau, V., 10:11559
Drell, S.D., Constraints on radiative Z_0 decays, 10:11849 (J;US)
Drescher, H.E., Analysis of fission product transport parameters in the fuel element for temperatures up to 2500°C based on heat-up experiments and their application to heat-up incidents using the PNP-500 as example, 10:11130 (R;DE;In German)
Dressler, G., Methods for QC fuel assemblies, 10:11084 (RA;DE)
Drews, G., *See* Albrecht, H., 10:11816
Drexler, J., *See* Vesely, P., 10:11135
Drickamer, H.G., *See* Peanasky, M.J., 10:11421
Drolshagen, G., Wave packet approach to inelastic scattering from large targets, 10:11777 (J;US)
Drumheller, D.S., *See* Bedford, A., 10:11911
Dubrawski, J.V., *See* Gill, W.W., 10:10856
See Rigby, G.R., 10:10857
Duek, E., *See* Jacquet, D., 10:11886
Duesterberg, T.J., *See* Wolcott, D.R., 10:11220, 10:11221
Dufour, R.J., Imagery and spectroscopy of supernova remnants and H-2 regions, 10:11741 (R;US)
Dugan, T.S., *See* Newman, S.M. Jr., 10:11666
Duke, T.W., Results of the Drilling Fluids Research Program sponsored by the Gulf Breeze Environmental Research Laboratory, 1976-1983, and their application to hazard assessment. Project summary, 10:10942 (R;US)
Dumont, J.N., *See* Newman, S.M. Jr., 10:11666
Dunbavan, M., *See* Mallett, C.W., 10:10900
Dunkerton, L.V., *See* Tyrrell, J., 10:11442
Dunlap, J.L., *See* Bell, J.D., 10:11965
Dupree, T.H., *See* Berman, R.H., 10:11951
Durand, B., Some comments on α/sub s/ and Λ/sub anti MS/, 10:11841 (R;US)
Durfee, R.C., *See* Petrich, C.H., 10:11197
DuVal, D.L., Selectivity variations in anion chromatography, 10:11428 (R;US)
Duwe, R., Storage characteristics of spent HTR fuel elements in transport and storage containers of modular cast iron, 10:11108 (R;DE;In German)
Dziegielewski, B., *See* Arey, D., 10:10931

E

Eaker, C.W., Fourier transform methods for calculating action variables and semiclassical eigenvalues for coupled oscillator systems, 10:11786 (J;US)
Early, J.J., *See* Brand, M.J., 10:11258
Easter, M.E., Calculated k-effectives for plutonium critical experiments. Consolidated Fuel Reprocessing Program, 10:10963 (R;US)
Easter, R.C., PLUVIUS: a generalized one-dimensional model of reactive pollutant behavior, including dry deposition, precipitation formation, and wet removal. Second edition, 10:11592 (R;US)
See Dana, M.T., 10:11593
Eastman, T.E., *See* Crooker, N.U., 10:11750
Ebbinghaus, W., *See* Wachtendonk, H.J. von, 10:11086
Eberhagen, A., *See* Becker, G., 10:11933
Eberly, J.H., Noise in strong laser-atom interactions: Phase telegraph noise, 10:11795 (J;US)
See Wodkiewicz, K., 10:11798
Eberz, J., *See* Kirchner, R., 10:11547
Eckart, M.J., *See* Matthews, D.L., 10:11499
Ecker, R.M., *See* Steelman, B.L., 10:11633
Eden, J.G., Visible and near-infrared dissociation lasers. Final report 21 January 1982-20 April 1984, 10:11494 (R;US)
Edwards, C., *See* Buckingham, M.J., 10:10889
Ehrhardt, J., Frequency distributions of activity concentrations after accidential releases of radionuclides, 10:11165 (R;DE;In German)
Ehrlich, K., *See* Herschbach, K., 10:11385
Ekberg, S.A., *See* Jones, L.H., 10:11772, 10:11787
Elevant, T., Proposed 14-MeV neutron spectrometer system for jet, 10:11947 (R;SE)
Elkind, M.M., *See* Hill, C.K., 10:11671
Elliott, D.C., *See* Sealock, L.J. Jr., 10:10843
Ellis, F.V., *See* Oldfield, W., 10:11373
Emery, A.T., OXY hydrogen-air fuel cell, 10:11254 (RA;US)
Endoh, Y., *See* Shirane, G., 10:11354
Enever, J.R., Geomechanical evaluation of alternative underground mining methods, 10:10899 (R;AU)
Engel, H., Use of the DOM software system in quality assurance with the manufacture of fuel elements for nuclear reactors, 10:11104 (RA;DE)
Engleman R. Jr., Precision isotope shifts for the heavy elements. III. Singly ionized thorium (Th II), 10:11793 (J;US)
Englert, S.B., Development of a cooled coaxial low flow velocimeter, 10:11148 (R;US)
Eoff, J.M., Mechanically assembled non-bonded tranducers utilizing PVDF film, 10:11513 (R;US)
Epler, J.L., *See* Waters, L.C., 10:11711
Eraslan, A.H., Application of zone-matching methodology to interacting submerged multiport diffusers, 10:11123 (R;US)
RADTWO: a computer code for simulating fast-transient, two-dimensional, two-layer radionuclide concentration conditions in lakes, reservoirs, rivers, estuaries, and coastal regions, 10:11636 (R;US)
Erdem, E., *See* Curtis, R.B., 10:11290
Ermak, D.L., *See* Koopman, R.P., 10:11598
Ernotte, M., Statistical evaluation of fuel and fuel assembly production, 10:11101 (RA;DE)
Errede, S., *See* Park, H.S., 10:11828
Esslinger, M.A., *See* Kern, R.D., 10:11475
Estabrook, K., Two-dimensional Lasnex ray-trace calculations of thermal whole beam self-focusing, 10:11952 (J;US)
See Kruer, W.L., 10:11949
Ethier, S.P., *See* Adams, L.M., 10:11680
Eto, J., *See* Curtis, R.B., 10:11290
Evangelou, V.P., *See* Grove, J.H., 10:10872
Evans, J.C. Jr., *See* Brodzinski, R.L., 10:11566
Evans, K., Tokamak fusion reactors with less than full tritium breeding, 10:11992 (J;US)
Evans, N., Nuclear power in the Western World to 2020, 10:11209 (R;GB)

F

Faber J. Jr., *See* Pluth, J.J., 10:11353
Faidas, H., Multiphoton ionization and excitation of fluoranthene and benzene in solution, 10:11467 (R;US)
Fairfax, S., *See* Greenwald, M., 10:11976
Faklis, D., *See* Kershner, C.J., 10:11497
Fander, U., Damage of the hepatic mixed functional oxygenase system by CCl_4. Significance of incorporation of C-14-Cl_4 metabolites in vivo, 10:11647 (R;DE)
Farlow, G.C., *See* McHargue, C.J., 10:11388
Farmayan, W.F., *See* Beer, J.M., 10:11013
Farmer, C.D., *See* Rothschild, E.R., 10:10978, 10:11625
Farnsworth, R.K., Effects of radial temperature gradients on glass fracture in simulated high-level waste canisters, 10:10984 (R;US)
Farooque, M., *See* Abens, S., 10:11257
Farrow, N.D., *See* Rothschild, E.R., 10:10978, 10:11625
Fawley, W.M., Synchrotron-betatron resonances in free-electron lasers, 10:11500 (J;US)
Fearing, H.W., Bremsstrahlung and radiative processes at medium energies, 10:11867 (R;CA)
Fedder, J.A., Region 1 Birkeland currents from a global MHD simulation of the magnetosphere. Memorandum report, October 1984-October 1985, 10:11733 (R;US)
Fee, D.C., Monolithic fuel cells, 10:11226 (R;US)
Monolithic fuel cells, 10:11245 (RA;US)
Solid oxide fuel cells, 10:11230 (RA;US)
Feibelman, P.J., Efficient solution of Poisson's equation in linear combination of atomic orbitals

(LCAO) electronic structure calculations, 10:11785 (J;US)
Feige, G., *See* Dersch, G., 10:11873
Felch, K., *See* Jory, H., 10:11973
Feldman, W.C., Power dissipation at slow-mode shocks in the distant geomagnetic tail, 10:11755 (J;US)
See Hones E.W. Jr., 10:11752
See Scarf, F.L., 10:11753
See Smith, E.J., 10:11754
Feldmeier, H., Dissipation and fluctuation of the relative momentum in nucleus-nucleus collisions, 10:11892 (R;DE)
See Spangenberger, H., 10:11891
Felst, R., *See* Bartel, W., 10:11814, 10:11817
Fennell, J.F., *See* Chenette, D.L., 10:11734
Fenner, H., *See* Behrend, H.J., 10:11815
Ferbel, T., *See* Collick, B., 10:11831
Fernandez, E., Direct photon production in e^+e^- annihilation, 10:11827 (J;US)
Recent results from PEP, 10:11821 (R;US)
Fernandez, J.P., *See* Burgess, E.L., 10:11046
Ferrett, T.A., *See* Lindle, D.W., 10:11789
Fessenden, R.W., *See* Huo, W.M., 10:11452
Fessler, H., Tower structured scintillator-lead photon calorimeter using a novel fiber optics readout system, 10:11564 (R;DE)
Fiala, B., *See* Vesely, P., 10:11135
Field, R.D., Research in theoretical elementary particle physics. Annual progress report, 10:11838 (R;US)
Fillo, J.A., *See* Powell, J.R., 10:12000
Finch, C.B., *See* Williams, R.K., 10:11397
Fincke, J.R., *See* Englert, S.B., 10:11148
Finke, G., Energy-supply-independent after-heat removal in nuclear propulsion plants for ships in combination with sinking and cantering, 10:11098 (R;DE;In German)
Fiore, C., *See* Greenwald, M., 10:11976
Fischer, G.E., Value of lymphography in the diagnosis of urological tumors, 10:11652 (R;DE;In German)
Fisk, Z., *See* Ott, H.R., 10:11355
See Thompson, J.D., 10:11359
See Willis, J.O., 10:11357
Fitzner, R.E., *See* Rickard, W.H., 10:11626
FitzPatrick, V.F., *See* Buelt, J.L., 10:10979
Flagan, R.C., Synthetic chars for studies of char combustion mechanism. Quarterly technical progress report, September 1-December 1, 1984, 10:10925 (R;US)
Fleming, D.G., *See* Heffner, R.H., 10:11573
Flood, P.G., Facies modelling and palaeoenvironmental reconstruction of coal measures sedimentation within several Queensland coal basins, 10:10892 (R;AU)
Floreen, S., *See* Nelson, J.L., 10:11096
Flume, R., Quantum mechanics with extended supersymmetry and nonabelian gauge constraints, 10:11850 (R;DE)
Fogarassy, E., *See* Pennycook, S.J., 10:11407
Fontijn, A., Kinetic measurements on elementary fossil fuel combustion reactions over wide temperature ranges. Progress report, May 1, 1984-November 30, 1984, 10:11476 (R;US)
Ford, J.L.C. Jr., *See* Shapira, D., 10:11868
Ford, W.T., Improved b lifetime measurement from MAC, 10:11820 (R;US)
Trigger drift chamber for the MKII upgrade at PEP, 10:11544 (R;US)
See Fernandez, E., 10:11827
Foropoulos J. Jr., *See* Berkowitz, J., 10:11450
Foster, B., *See* Binnie, D.M., 10:11557
Foster, C.A., Pellet fuelling development at Oak Ridge National Laboratory, 10:12002 (BA;GB)
Foster, G.W., *See* Park, H.S., 10:11828
Foulds, J.R., Deformation behavior of a 16-8-2 GTA weld as influenced by its solidification substructure, 10:11370 (J;US)
Foure, M., *See* Nury, J.C., 10:11126
Fowler, M.M., Long-range atmospheric tracer field test, 10:11604 (J;GB)
Fox, L., *See* Jory, H., 10:11973
Francis, A.A., *See* Regan, J.D., 10:11701
Francis, C.W., Mobility of toxic compounds from hazardous wastes. Report for January 1982-December 1983, 10:11190 (R;US)
Franco, P.J., Effects of chronic exposure to coal-derived oil on freshwater ecosystems. I. Microcosms, 10:10886 (J;US)
See Giddings, J.M., 10:10887
Frank, L.A., *See* Crooker, N.U., 10:11750
Franke, G., *See* Behrend, H.J., 10:11815
Franse, J.J.M., *See* Willis, J.O., 10:11357
Fraser, H.L., *See* Konitzer, D.G., 10:11366
Frazier, M.E., Transformation of Syrian hamster embryo cells by synfuel mixtures, 10:11694 (J;US)
Frederick, G.S., *See* Conn, A.F., 10:11309
Freeman, D.L., Quantum Monte Carlo study of the thermodynamic properties of argon clusters: The homogeneous nucleation of argon in argon vapor and "magic number" distributions in argon vapor, 10:11448 (J;US)
French, R.H., Flood hazard assessment on alluvial fans: an examination of the methodology, 10:11185 (R;US)
Freund, P., *See* Fessler, H., 10:11564
Freytag, D.R., Performance report for Stanford/SLAC Microstore Analog Memory Unit, 10:11552 (R;US)
Friedlander, E.M., *See* Dersch, G., 10:11873
Friedman, M.J., Spectral properties for the magnetization integral operator, 10:11925 (J;US)
Frieze, W.E., *See* Schultz, P.J., 10:11760
Fritz, I.J., *See* Schirber, J.E., 10:11415
Fritze, P., *See* Comminchau, V., 10:11559
Frobose, R.H., CLARET user's manual: Mainframe Logs. Revision 1, 10:12017 (R;US)
Frome, E.L., Macro for fitting nonlinear models to Poisson distributed data, 10:11927 (R;US)
Frost, D., *See* Jalan, V., 10:11261
Fry, R.J.M., *See* Hanson, W.R., 10:11681
Fryer, M.O., Contribution of instrumentation and control software to system reliability, 10:12012 (R;US)
Thermocouple modeling, 10:11094 (R;US)
Fu, C.L., Vibrational frequencies and structural properties of transition metals via total-energy calculations, 10:11339 (R;US)
Fujii, Y., *See* Axe, J.D., 10:11395
Fujiwara, F.G., *See* Henke, B.L., 10:11575
Fuller, G.M., *See* Sager, P.H., 10:12001
Fussmann, G., *See* Becker, G., 10:11933

G

Gaines, L.L., Economics of hydrogen production, 10:11010 (R;US)
Gajewski, W., *See* Park, H.S., 10:11828
Galimberti, M.M., *See* Hochard, G.P., 10:11103
Galin, J., *See* Jacquet, D., 10:11886
Galloway, J.N., Acid precipitation: natural versus anthropogenic components, 10:11600 (J;US)
Gan Fuxi, Research and development of laser glasses in China, 10:11501 (J;CN;CH)
Ganezer, K.S., *See* Park, H.S., 10:11828
Ganguli, G., *See* Satyanarayana, P., 10:11747
Gano, K.A., *See* Klepper, E.L., 10:11665
Garber, D.I., *See* Diamond, D.J., 10:11138
Garbutt, D.A., *See* Binnie, D.M., 10:11557
Garcia, A.S., Criticality safety training at the Hot Fuel Examination Facility, 10:11482 (R;US)
Garcia-Molina, R., Excitation of edge modes in the interaction of electron beams with dielectric wedges, 10:11774 (J;US)
Gardes, D., *See* Jacquet, D., 10:11886
Gardner, R., *See* Cabrera, B., 10:11490
Gardner, R.H., *See* O'Neill, R.V., 10:11634
Garner, F.A., Influence of titanium on the neutron-induced swelling of austenitic alloys, 10:11336 (R;US)
Garrett, B.C., *See* Brown, F.B., 10:11447
Garrigues, C., Industrial energy conservation in Morocco and Senegal, 10:11305 (RA;US)
Potential for energy conservation in Dakar transportation system, 10:11301 (RA;US)
Garten, C.T. Jr., Field studies on the terrestrial behavior of actinide elements in East Tennessee, 10:11619 (R;US)
Gay, D.D., Micro-column plasma emission liquid chromatograph, 10:11580 (P;US)
Gebauer, J., *See* Fessler, H., 10:11564
Gehlen, G. von, *See* Hoeger, C., 10:11917
Gehre, O., *See* Becker, G., 10:11933
Geisling, K.L., *See* Meyer, B., 10:11603
Gelb, A., *See* Wilemski, G., 10:11249, 10:11276
Gelfond, L., 4.8-megawatt demonstrator. Progress report, 10:11239 (RA;US)
Gelting, R.L., *See* Breault, R.D., 10:11275, 10:11277
Gentry, W.R., *See* Hall, G., 10:11790
Gerber, M.A., *See* Schiefelbein, G.F., 10:11018
Gerlach, K., *See* Deuber, H., 10:11124
Gernhardt, J., *See* Becker, G., 10:11933
Geusic, M.E., Hydrogen chemisorption on transition metal clusters, 10:11449 (J;US)
Giddings, J.M., Effects of chronic exposure to coal-derived oil on

freshwater ecosystems. II. Experimental ponds, 10:10887 (J;US)
See Franco, P.J., 10:10886
Gielecki, M., Commercial Nuclear Power 1984: prospects for the United States and the World, 10:11074 (R;US)
Gierke, G. von, *See* Becker, G., 10:11933
Giese, C.F., *See* Hall, G., 10:11790
Gilbert, R.O., *See* Rogers, L.E., 10:11670
Gilbert, T.D., *See* Shibaoka, M., 10:10858
Giles, J.E., Application of MINOS to a thermal ramping problem, 10:11218 (R;US)
Gill, P.E., Software and its relationship to methods, 10:12016 (R;US)
Gill, W.W., Comparative study of world blast furnace cokes: behaviour of ash components, 10:10856 (R;AU)
Gilliam, D.M., Absolute fission chambers for high-energy neutron fields. Final report, 10:11941 (R;US)
Gilligan, J.G., *See* Carroll, M.C., 10:11994
See Evans, K., 10:11992
Ginley, D.S., Effective monatomic hydrogen diffusion constants in polycrystalline silicon, 10:11032 (RA;US)
Ginocchio, J.N., Low-lying isovector excitations in heavy nuclei, 10:11879 (R;US)
Gioumousis, A., *See* Briggs, D., 10:11569
Girgis, M.A., *See* Block, D.L., 10:11050
Glad, A.S., Computer control and data acquisition for neutral beam injectors, 10:11996 (BA;GB)
Glanz, J., *See* Olson, L., 10:11967
Glanzman, T., *See* Brafman, H., 10:11554
Glas, K.M., *See* Fessler, H., 10:11564
Glass, G., Measurements of spin-correlation parameters A/sub L/L and A/sub S/L for pp→πd between 500 and 800 MeV, 10:11829 (J;US)
Glendenning, N.K., Phase transitions in nuclear matter, 10:11893 (R;US)
Glock, E., *See* Becker, G., 10:11933
Gloeckler, G., *See* Scholer, M., 10:11751, 10:11757
Gmeindl, F.D., *See* Zeh, C.M., 10:11247
Gneiting, B.C., *See* Slagle, O.D., 10:11128
Goeltz, R., *See* Hirst, E., 10:11292, 10:11293
Gold, R.E., *See* Conn, R.W., 10:11993
Golden, D.W., *See* Broughton, J.M., 10:11152
Goldhaber, M., *See* Park, H.S., 10:11828
Goldman, A., *See* Rinsland, C.P., 10:11589
Goldwire, H.C. Jr., *See* Koopman, R.P., 10:11598
Gole, J.L., Characterization of high temperature vapors of import to combustion and gasification processes in the energy technologies. Final report, March 1, 1980-March 1, 1981, 10:10835 (R;US)
Goller, G.J., *See* Breault, R.D., 10:11275, 10:11277
Golub, G.H., *See* Boley, D., 10:12022
Gomez del Campo, J., *See* Shapira, D., 10:11868
Gonzalez, E.R., Electrochemistry of fuel cells for transportation applications, 10:11280 (J;GB)
See Srinivasan, S., 10:11262
Gonzalez, R., *See* Chen, Y., 10:11398
Good, R.R., Automated data qualification, 10:11147 (R;US)
Goodrich, J.A., *See* Grayman, W.M., 10:11631
Goodrich, L.D. Jr., *See* Good, R.R., 10:11147
Goodrich, P., *See* Sevillano, E., 10:11930
Goradia, C., Applicability of the Meyer—Neldel rule to solar cells, 10:11039 (J;US)
Gorbics, M.S., Study of charm production in proton-proton interactions at $\sqrt{s}$ = 62 GeV with a forward K^- trigger, 10:11823 (R;US)
Gore, B.F., Consequence analysis of a hypothetical contained criticality accident in the Hanford Critical Mass Laboratory, 10:11168 (R;US)
Goree, J., Far-infrared laser scattering in the ACT-I toroidal device, 10:11944 (R;US)
Observation of the backward electrostatic ion cyclotron wave, 10:11946 (R;US)
Gorsky, V., Principles governing the organization of quality control in the fabrication of water reactor fuel elements, 10:11107 (RA;DE)
Gose, G.C., *See* Peterson, C.E., 10:11174, 10:11175
Gosling, J.T., Plasma entry into the distant tail lobes: ISEE-3, 10:11756 (J;US)
Gottschalk, T., *See* Derrick, M., 10:11833
Gould, H., Charge changing cross sections of relativistic uranium, 10:11551 (R;US)
Gourdin, W.H., Comments on bonding processes during the dynamic compaction of metallic powders, 10:11376 (J;CH)
Goyert, J.C., *See* Francis, C.W., 10:11190
Grady, D.E., Mechanisms of dynamic fragmentation: factors governing fragment size, 10:11478 (R;US)
Graham, W.G., *See* Tanis, J.A., 10:11781
Gralla, S., Reaction mechanisms in the collision of ^{92}Mo on ^{92}Mo at an incident energy of 14.7 MeV/Nucleon, 10:11876 (R;DE;In German)
Gramm, E., Experiments for improving the roentgen imaging and thus the caries diagnosis in the approximal space of lateral teeth, 10:11648 (R;DE;In German)
Grand, P., Breeding nuclear fuels with accelerators: replacement for breeder reactors, 10:11540 (R;US)
Granoff, B., Coal liquefaction research. Quarterly report, April-June 1984, 10:10849 (R;US)
Gras-Marti, A., *See* Garcia-Molina, R., 10:11774
Graves, D.H., *See* Alderdice, L., 10:10874
Grayman, W.M., Development of toxic screening models for surface water supplies, 10:11631 (R;US)
Green, W.V., Summary of the Rigi-Kaltbad workshop on graphite, 10:11422 (J;NL)
Greenblatt, M., *See* Axe, J.D., 10:11395
Greene, G.A., Correlation of local heat flux from inclined volume-heated pools in bubbly flow, 10:11512 (J;US)
Greene, J.C., *See* Thomas, J.M., 10:11618
Greene, J.P., *See* Berkowitz, J., 10:11450
Greene, R.T., *See* Turner, J.E., 10:11903
Greenwald, M., Confinement results from pellet fueled discharges in Alcator C, 10:11976 (R;US)
Greif, R., *See* Mertol, A., 10:11068
Greiner, D., *See* Gould, H., 10:11551
Greiner, N.R., *See* Lyman, J.L., 10:11469
Gresho, P.M., *See* Koseff, J.R., 10:11506
Griesemer, R., *See* Lock, S., 10:11687
Griffioen, K.A., Coincidence electron scattering (e,e'f) and multipole strength functions in ^{238}U, 10:11885 (J;US)
Griffiths, J.M., *See* King, D.W., 10:12026, 10:12027, 10:12029
Griffiths, T.D., *See* Meechan, P.J., 10:11678, 10:11679
Grilly, E.R., *See* Schwalbe, L.A., 10:11453
Grisso, J.R., Assessment of options for small-scale lignite fueled cogeneration plants, 10:11244 (RA;US)
Grissom, M.C., In-situ coal gasification: a bibliography, 10:10844 (R;US)
Griswold, J.W., Fuel motivated approach to fuel cell application, 10:11243 (RA;US)
Grodzka, P., Feasibility study of binary solutions for thermal energy storage in high and low temperature applications, 10:11177 (R;US)
Gronager, J.E., Preliminary observation of large scale UO_2 melt-concrete interactions and sustained steel-concrete interaction with an overlying water pool, 10:11173 (R;US)
Grossweiner, L.I., Mechanisms of photosensititization by furocoumarins, 10:11686 (R;US)
Grove, J.H., Modeling water quality during salty spoil suspension events, 10:10872 (RA;US)
Gruber, K., Fabrication and quality control of mixed oxide LWR fuel with regard to homogeneity of fissile content, 10:11083 (RA;DE)
Grumbrecht, K., Detection of fire hazards in belt conveyors in coal mines, 10:10905 (TG;GB)
Grunberger, D., *See* Jones, C.A., 10:11710
Guenther, C., *See* Schira, P., 10:11509
Guerreau, D., *See* Jacquet, D., 10:11886
Guither, H.D., Economic effects of subsidence from underground coal mining on agricultural land in Illinois. Open file report, 1 September 1982-30 November 1984, 10:10879 (R;US)
Gupta, A.K., *See* Beer, J.M., 10:11013
Gustavson, D.B., FASTBUS software progress, 10:11520 (R;US)
Gwinn, D., *See* Greenwald, M., 10:11976
Gyorffy, B.L., *See* Stocks, G.M., 10:11328
Gyulassy, M., Space station as quark matter factory, 10:11877 (R;US)
See Danielewicz, P., 10:11848

H

Haas, G., *See* Becker, G., 10:11933
Haase, C.S., *See* Rothschild, E.R., 10:10978
Hackl, H., *See* Engel, H., 10:11104
Hadden, C.T., *See* Adler, H.I., 10:11663
Hagelstein, P.L., *See* Matthews, D.L., 10:11499
See Rosen, M.D., 10:11498
Haidt, D., *See* Bartel, W., 10:11814, 10:11817
Haines, T.J., *See* Park, H.S., 10:11828
Haire, R.G., *See* Huray, P.G., 10:11378
Hakkinen, P.J., Potentiating effects of oxygen in lungs damaged by

methylcyclopentadienyl manganese tricarbonyl, cadmium chloride, oleic acid, and antitumor drugs, 10:11693 (J;US)
See Haschek, W.M., 10:11708
Halbach, K., Application of permanent magnets in accelerators and electron storage rings, 10:11532 (R;US)
Halbritter, J., *See* Kresin, V., 10:11913
Hales, J.M., *See* Easter, R.C., 10:11592
Hall, G., State-to-state vibrational excitation of I_2 in collisions with He, 10:11790 (J;US)
Hall, J., *See* Adler, H.I., 10:11663
Hall, M.C.G., *See* Cacuci, D.G., 10:11602
Halperin, W.P., *See* Yudkowsky, M., 10:11356
Halverson, J.E., Review of applications of mass spectrometry to low level radionuclide metrology, 10:11431 (J;NL)
Halverson, M.A., *See* Sutter, S.L., 10:11612
Hamaguchi, Hiroshi, Indirect determination of rhenium by EDTA titration, 10:11436 (TJ;US)
Hamasaki, Y., *See* Kishida, K., 10:11253
Hamilton, J.C., Isotope studies of Fe-18Cr-3Mo (100) oxidation using Raman spectroscopy, 10:11351 (R;US)
Hamilton, L.D., Alternative interpretations of statistics on health effects of low-level radiation, 10:11682 (J;US)
Hamm, R.N., *See* Turner, J.E., 10:11903
Hamnen, H., Fast alpha particle distribution function in an open field-line plasma with electrostatic confining potential, 10:11932 (R;US)
Han, A., *See* Hill, C.K., 10:11671
Han, C., Coal cleaning by froth flotation, 10:10913 (R;US)
Hand, W.M., Qualification testing of photodiode, semiconductor, silicon 400-2931, 10:11518 (R;US)
Hangarter, K., *See* Comminchau, V., 10:11559
Hanna, W.W., Development of innovative techniques and principles that may be used as models to improve plant performance. Progress report, 10:11668 (R;US)
Hanson, D.A., Integration of energy/economic models for environmental assessments and policy analysis, 10:11184 (R;US)
Hanson, G.G., *See* Burchat, P.R., 10:11568
Hanson, G.H., Application of ANSI/ANS-5.1-1979/HEATSG code to LOFT technical specifications, 10:11132 (R;US)
Hanson, J.D., *See* Hamnen, H., 10:11932
See Ott, E., 10:11923
Hanson, W.R., Relative biological effectiveness measurements using murine lethality and survival of intestinal and hematopoietic stem cells after Fermilab neutrons compared to JANUS reactor neutrons and ^{60}Co gamma rays, 10:11681 (J;US)
Harder, G., *See* Albrecht, H., 10:11816
Harfouche, E.H., *See* Rybicki, E.F., 10:10950
Harmon, B.A., *See* Shapira, D., 10:11868
Harris, C.B., *See* Alivisatos, A.P., 10:11775
Harris, D.B., *See* Welch, D.R., 10:11956
Harris, L.A., Application of scanning electron microscopy and ultraviolet fluorescence to a study of Chattanooga shale specimens, 10:11616 (J;US)
Harris, T.D., Bio-conversion of broiler house litter. Final report, 10:11016 (R;US)
Harrison, T.D., Effects of reflector augmentation on fixed polycrystalline arrays, 10:11047 (RA;US)
See Burgess, E.L., 10:11046
Hart, B.L., *See* Verosub, K.L., 10:11717
Harter, W.G., Patterns of energy levels and spectra for polyatomic molecules, 10:11799 (J;US)
Harty, R., *See* Reece, W.D., 10:11905
Haschek, W.M., Pathology of acute inhalation exposure to 3-methylfuran in the rat and hamster, 10:11708 (J;US)
See Hakkinen, P.J., 10:11693
Hasemann, H., *See* Albrecht, H., 10:11816
Hastings, D.E., Development of a differential equation for the ambipolar electric field in a bumpy torus in the low collision frequency limit, 10:11987 (J;US)
Differential equation for the ambipolar electric field in a multiple-helicity torsatron, 10:11950 (J;US)
Electron transport in the ELMO bumpy torus in the low collision frequency limit, 10:11962 (J;US)
Hatcher, C.W., *See* Matthews, D.L., 10:11499
Hauf, R., Environmental effects of electro-magnetic fields, 10:11713 (TJ;GB)
Hausler, T., *See* Perry, J.H., 10:10929
Havris, C., Quality control considerations in fuel assembly fabrication for natural uranium reactors, 10:11109 (RA;DE;In French)
Hawelka, P., *See* Comminchau, V., 10:11559
Hawley, D.L., *See* Shines, J.E., 10:11623
Hawley, M.E., *See* Galloway, J.N., 10:11600
Hawryluk, A.M., *See* Matthews, D.L., 10:11499
Haxton, W.C., *See* Wolfsberg, K., 10:11740
Hay, P.J., Ab initio effective core potentials for molecular calculations. Potentials for the transition metal atoms Sc to Hg, 10:11778 (J;US)
Ab initio effective core potentials for molecular calculations. Potentials for K to Au including the outermost core orbitals, 10:11780 (J;US)
See Wadt, W.R., 10:11779
Hayes, J.V., *See* Raynor, G.S., 10:11606
Hayes, T.D., *See* Chynoweth, D.P., 10:11012
Haymore, J.L., Cooling tower wood sampling analyses: a case study, 10:11484 (R;US)
Hazi, A.U., *See* Matthews, D.L., 10:11499
See Rosen, M.D., 10:11498
He, D., *See* Morsi, B.I., 10:10912
Healy, T.W., Oil agglomeration: fundamental studies, 10:10914 (R;AU)
Heartlein, M.W., SCE induction is proportional to substitution in DNA for thymidine by CldU and BrdU, 10:11709 (J;NL)
Heath, M.T., Sparse matrix computations, 10:11926 (R;US)
Hecker, S.S., *See* Stout, M.G., 10:11367
Hedrick, C.L., Introduction to magnetic equilibria and single-particle orbits in the square configuration of EBT: a tutorial, 10:11937 (RA;US)
MHD ballooning modes in the ELMO Bumpy Torus, 10:11939 (RA;US)
Heffner, R.H., Muon spin relaxation, 10:11573 (J;US)
See Boekema, C., 10:11394
Heiman, D.F., *See* Kiesewetter, D.O., 10:11660
Heimann, P.A., *See* Lindle, D.W., 10:11789
Heisig, V., Fluorescence-line-narrowed spectra of polycyclic aromatic carcinogen-DNA adducts, 10:11642 (J;US)
Heldt, L.A., *See* Hintz, M.B., 10:11380
Heller, E.D., Public opinion polls on nuclear energy. Analysis of demoscopic findings, 10:11638 (R;DE;In German)
Heller, E.J., *See* Drolshagen, G., 10:11777
See Eaker, C.W., 10:11786
Heller, J.P., Mobility control for CO_2 injection (support for field project). Fourteenth quarterly report including project status report, August 17-November 17, 1984, 10:10937 (R;US)
Hellmer, R.P., *See* Ginley, D.S., 10:11032
Helmer, R.G., Nuclear data sheets for A = 161, 10:11880 (J;US)
Helton, J.C., *See* Iman, R.L., 10:11169
Hender, T.C., *See* Holmes, J.A., 10:11953
Henke, B.L., Low-energy x-ray response of photographic films. II. Experimental characterization, 10:11575 (J;US)
Hensley, W.K., *See* Brodzinski, R.L., 10:11566
Heppelmann, S., *See* Collick, B., 10:11831
Herbes, S.E., *See* Franco, P.J., 10:10886
Herbig, J., Introduction to CHART: a graphic analysis and display system. Revision, 10:12015 (R;US)
Herrmann, E., *See* Engel, H., 10:11104
Herrmann, J., *See* Dersch, G., 10:11873
Hersch, C.A., Sliding-Bed (trademark) aluminum-scrap preheater. Final report, October 1982-May 1984, 10:11310 (R;US)
Herschbach, K., Irradiation-induced creep and swelling of austenitic material No. 1.4981 between 400 and 500°C (RIPCEX I), 10:11385 (TJ;GB)
Herten, U., *See* Comminchau, V., 10:11559
Herton, P.A., *See* Jackson, W.R., 10:10847
Hesketh, H.E., Use of fluidized bed coal combustion techniques to study efficiency, emission reduction, boiler effects, and waste utilization, 10:10922 (RA;US)
Hetzler, F., *See* Dressler, G., 10:11084
Hewlett, J., *See* Gielecki, M., 10:11074
Heyer, S.V., Evaluation of underground dc transmission systems. Final report, 10:11070 (R;US)
Heystek, H., *See* Clancy, T., 10:10840
Hicks, B.B., *See* Ward, R.C., 10:11608
Hicks, H.R., *See* Holmes, J.A., 10:11953
Hiebert, J.C., *See* Glass, G., 10:11829
Hiemstra, S.L., *See* Crampton, L.S.W., 10:11189

Hilber, H.C., Nuclear reaction n + ^{3}He -> ^{1}H + ^{3}H as proximity reaction, 10:11869 (R;DE;In German)
Hildebrand, C.E., *See* Seagrave, J.C., 10:11700
Hill, C.K., Possible error-prone repair of neoplastic transformation induced by fission-spectrum neutrons, 10:11671 (R;US)
Hill, D.J., *See* Bergen, A.R., 10:11073
Hinckley, C.C., *See* Tyrrell, J., 10:11442
Hines, J.F., *See* Petrich, C.H., 10:11197
Hintz, M.B., Chemical state investigation of grain boundary segregated sulfur in polycrytstalline nickel, 10:11380 (J;US)
Hioe, F.T., Theory of generalized adiabatic following in multilevel systems, 10:11503 (J;NL)
Hira, A.U., *See* Rentz, R.L., 10:11248
Hirsch, J.J., *See* Curtis, R.B., 10:11290
Hirst, E., Conservation's value varies with view, 10:11311 (J;US)
Energy savings one and two years after participation in Minnesota home energy audit and retrofit loan programs, 10:11293 (R;US)
Three years after participation: electricity savings due to the BPA Residential Weatherization Pilot Program, 10:11292 (R;US)
Hobbins, R.R., *See* Osetek, D.J., 10:11145
Hochard, G.P., Surveillance by EDF of PWR fuel assembly fabrication, 10:11103 (RA;DE;In French)
Hochheiser, H.G., *See* Hanson, D.A., 10:11184
Hochheiser, H.W., *See* Kuuskraa, V.A., 10:10940
Hoeffner, S.L., Strontium sorption on Savannah River Plant soils, 10:10999 (R;US)
Hoeger, C., Finite-size scaling for quantum chains with an oscillatory energy gap, 10:11917 (R;DE)
Hoenig, S.A., Clean-up of producer and synthesis gas with a tube and wire electrostatic precipitator, 10:11024 (J;GB)
Hogan, J.T., Collisional transport of momentum in axisymmetric configurations, 10:11961 (J;US)
Hojvat, C., *See* Simpson, J., 10:11536
Holland, J.M., *See* Shugart, L., 10:11706
Hollander, M., *See* Mathez, E.A., 10:11721
Hollins, R.C., *See* Jordon, D.L., 10:11493
Holmes, H.F., Isopiestic studies of aqueous solutions at elevated temperatures. VII. $MgSO_4$ and $NiSO_4$, 10:11454 (J;GB)
Holmes, J.A., Nonlinear interaction of tearing modes: A comparison between the tokamak and the reversed field pinch configurations, 10:11953 (J;US)
Holz, P.P., *See* Cheverton, R.D., 10:11149
Holzer, R., Experience with quality assurance in fuel design and manufacturing, 10:11100 (RA;DE)
Hombach, H.P., *See* Schneiderman, S., 10:10852
Hones E.W. Jr., Detailed examination of a plasmoid in the distant magnetotail with ISEE 3, 10:11752 (J;US)
See Gosling, J.T., 10:11756
Hook, L.A., *See* Franco, P.J., 10:10886
See Giddings, J.M., 10:10887
Hoover, D.Q., Performance characteristics of solid oxide fuel cells, 10:11255 (RA;US)
Horelick, D., *See* Briggs, D., 10:11569
Horiuchi, N., Applications of fuel cell power plants in Japanese utility use, 10:11272 (RA;US)
See Kodama, T., 10:11269
Horton, A.I., 95 stimulations in 63 wells, 10:10951 (J;ZZ)
Horton, C.Y., *See* Revis, N.W., 10:11707
Hosker, R.P. Jr., *See* Ward, R.C., 10:11608
Hovestadt, D., *See* Scholer, M., 10:11751, 10:11757
Howard, D.W., *See* Rodman, M., 10:11137
Howe, H.C., *See* Bell, J.D., 10:11965
Hruby, J.M., Solid particle receiver experiments: radiant heat test, 10:11059 (R;US)
Hsiao, D.K., Future database machine architectures, 10:12007 (R;US)
Hsiao, M.Y., Particle-confinement criteria for axisymmetric field-reversed magnetic configurations, 10:11966 (J;AT)
Hu, S.C., Pre-eutectic densification in MgF_2-CaF_2, 10:11401 (J;IT)
Hu, W.L., Charpy impact test results of ferritic alloys at fluence to 6 x 10^{22} n/cm , 10:11338 (R;US)
Huang, F.H., Effects of irradiation on the fracture toughness of HT-9, 10:11337 (R;US)
Huang, H.C.W., *See* Park, J.Y., 10:11374
Huang, J.C., Effect of liquid-phase diffusion resistance on retention time in gas-liquid chromatography, 10:11435 (J;US)
Huber, M., *See* Cabrera, B., 10:11490
Huberman, E., *See* Jones, C.A., 10:11710
Hueneke, B., Ultrasonic mammography. Value and meaning of the method in comparison to X-ray mammography, thermography, and fine needle biopsy, 10:11655 (R;DE;In German)
Huey, H., *See* Jory, H., 10:11973
Huff, D.D., *See* Ketelle, R.H., 10:10977
See Rothschild, E.R., 10:10978, 10:11200, 10:11625
Huggins, J.C., *See* Block, D.L., 10:11050
Hulett, L.D., *See* Rosseel, T.M., 10:11762
Hulligan, D.D., Effect of water on hydrogen permeability, 10:11317 (R;US)
Hulliger, F., *See* Ott, H.R., 10:11355
Humm, H.J., *See* Betzer, P.R., 10:11017
Humphrey, J.A.C., *See* Koseff, J.R., 10:11506
Huntington, H.G., *See* Hanson, D.A., 10:11184
Huo, W.M., Thermal electron attachment to van der Waals molecules containing O_2, 10:11452 (J;US)
Huray, P.G., Magnetism of the heavy 5f elements, 10:11378 (J;CH)
Hurst, G.S., Proposed solar neutrino experiment using ^{81}Br(nu,e$^-$)^{81}Kr, 10:11736 (R;US)
See Turner, J.E., 10:11903
Huston, J., *See* Collick, B., 10:11831
Hutchings, B.J., *See* Block, D.L., 10:11050
Hutchinson, D., *See* Briggs, D., 10:11569
Huth, O., Studies on irradiated lactate dehydrogenase using gel electrophoresis, 10:11674 (R;DE;In German)
Hutson, R.L., *See* Boekema, C., 10:11394
Hwa, T., Estimate of particle fluxes from the IR's at the SSC, 10:11534 (R;US)
Hwang, W., *See* Panayotatos, P., 10:11041
Hyde, P.J., *See* Srinivasan, S., 10:11262

I

Ibach, T., Measurement of the radial density distribution of the light emissions near the trajectory of fast ions in nitrogen, 10:11898 (R;DE;In German)
Ide, M., *See* Sakai, T., 10:11268
Iglesias, C.A., *See* Boercker, D.B., 10:11796
Iman, R.L., Overview of methods for uncertainty analysis and sensitivity analysis in probabilistic risk assessment, 10:11169 (R;US)
Incoccia, L., *See* Comin, F., 10:11417
Inoue, G., Laser induced fluorescence study of Xe($5p^56p$, $5p^56p'$, $5p^57p$, and $5p^56d$) states in Ne and Ar: Radiative lifetimes and collisional deactivation rate constants, 10:11792 (J;US)
Ipavich, F.M., *See* Scholer, M., 10:11751, 10:11757
Irby, J., *See* Sevillano, E., 10:11930
Irving, P.M., Acidic precipitation effects on crops: a review and analysis of research, 10:11690 (J;US)
Isaacs, H.S., Applications of the vibration probe to localized current measurements, 10:11326 (R;US)
Local electrochemistry of pitting corrosion in stainless steels, 10:11325 (R;US)
Isenberg, A.O., Advancing from single cell technology to generator engineering: A SOFC status report, 10:11246 (RA;US)
Ishikawa, Y., *See* Shirane, G., 10:11354
Ishikawa, Yuichi, *See* Isaacs, H.S., 10:11326
Iskander, S.K., *See* Cheverton, R.D., 10:11149
Itoh, N., *See* Horiuchi, N., 10:11272
See Ogura, Y., 10:11265
Iucovangelo, C.D., *See* Baumgartner, C.E., 10:11278
Ives, L., *See* Jory, H., 10:11973
Iwao, M., *See* Pelroy, R.A., 10:11702

J

Jackiw, R., Three-cocycle in mathematics and physics, 10:12019 (J;US)
Jackson, W.B., *See* Biegelsen, D.K., 10:11037
Jackson, W.R., Regeneration of catalysts for use in continuous flow coal hydrogenation, 10:10847 (R;AU)
Jacobs, G.K., *See* Kelmers, A.D., 10:11001
Jacobs, H., Influence of gradual density transition and nonlinear saturation on Rayleigh-Taylor instability growth, 10:11934 (R;DE)
Jacobson, V., *See* Theil, E., 10:11977

Jacquet, D., Reaching the capacity of a composite nucleus for energy and spin containment, 10:11886 (J;US)
Jalan, V., Advanced electrocatalysts and supports for phosphoric acid fuel cells, 10:11261 (RA;US)
James, C.R., *See* Marchand, R., 10:11984
Janney, M.A., Particulate toughened silicon carbide, 10:11404 (R;US)
Janowitz, G.S., Effects of alongshore variation in bottom topography on a boundary current (topographically induced upwelling), 10:11731 (J;GB)
Jarlskog, C., Flavor mixing and the six quark model, 10:11854 (R;SE)
Jarmer, J.J., *See* Glass, G., 10:11829
Jeffery, C.L., *See* Anderson, J.V., 10:11122
Jeffrey, A.M., *See* Heisig, V., 10:11642
Jellison, G.E. Jr., *See* Lowndes, D.H., 10:11406
Jenkins, C., *See* Binnie, D.M., 10:11557
Jenkins, K.D., Metal regulation and toxicity in aquatic organisms, 10:11703 (BA;US)
Jensen, T., *See* Collick, B., 10:11831
Jeppesen, R.H., *See* Glass, G., 10:11829
Jhirad, D.J., Importance of energy efficiency in the developing countries, 10:11303 (RA;US)
Introduction and background, 10:11282 (RA;US)
Jobst, J.E., Aerial radiological monitoring survey, Savannah River Plant, 10:11620 (R;US)
Johnson, B.M., Synchrotron radiation production and trapping of highly charged ions, 10:11538 (R;US)
See Meron, M., 10:11759
Johnson, D.E., *See* Diebold, R., 10:11537
Johnson, F.M., *See* Popp, R.A., 10:11691
Johnson, J.A. III, Turbulence and the distortion of reactions. Progress report, September 1, 1983-September 1, 1984, 10:11765 (R;US)
Johnson, J.N., Ductile fracture of rapidly expanding rings, 10:11492 (J;US)
Johnson, K.A., *See* Staudhammer, K.P., 10:11365
Johnson, K.G., The institutional Conservation Program: a success story, 10:11212 (BA;CA)
Johnson, N.M., *See* Biegelsen, D.K., 10:11037
Johnson, R., *See* Simpson, J., 10:11536
Joiner, J.R., *See* Anderson, J.M., 10:11251
Jonckheere, A., *See* Collick, B., 10:11831
Jones, A.R., *See* Hoover, D.Q., 10:11255
Jones, C.A., Cell specific activation of benzo[a]pyrene by fibroblasts and hepatocytes, 10:11710 (J;US)
Jones, D.E., *See* Tsurutani, B.T., 10:11758
Jones, G.J., Comparison of concentrating collectors to tracking flat panels, 10:11029 (RA;US)
See Thomas, M.G., 10:11044
Jones, K.W., *See* Johnson, B.M., 10:11538
See Meron, M., 10:11759
Jones, L.H., Orientational ordering and site structure of SiF_4 trapped in rare gas solids, 10:11787 (J;US)
Pulse expansion deposits and orientational ordering for low temperature matrices, 10:11772 (J;US)
Jones, M.S. Jr., Potential fuel cell application in the metallurgical industries, 10:11250 (RA;US)
Jones, O.C. Jr., *See* Greene, G.A., 10:11512
Jones, R.H., Role of segregated P and S in intergranular stress corrosion cracking of nickel, 10:11346 (R;US)
Jones, T.W., *See* Park, H.S., 10:11828
Jones, W.G., *See* Binnie, D.M., 10:11557
Jordon, D.L., Compact frequency-stable pulsed CO_2 laser, 10:11493 (R;GB)
Jorgensen, J.D., *See* Sokol, P.E., 10:11419
Jorgensen, J.E., *See* Sokol, P.E., 10:11419
Jory, H., 60 GHz, 200 kW CW gyrotron with high output mode purity, 10:11973 (R;US)
Joyce, L.S., *See* Adams, A.A., 10:11259
Joyce, T., *See* Collick, B., 10:11831
Jr., E.W.H., *See* Feldman, W.C., 10:11755
Jung, J., *See* Evans, K., 10:11992
Jurgensen, C.W., *See* Peanasky, M.J., 10:11421

K

Kaczvinsky, J.R. Jr., Studies of cation exchange for the isolation and concentration of trace level components of complex aqueous mixtures, 10:10974 (R;US)
Kaelne, E., *See* Vane, C.R., 10:11763
Kaelne, t., *See* Vane, C.R., 10:11763
Kalchthaler, R.F. Jr., Simplified modeling of slurry impoundment effluent water quality, 10:10871 (RA;US)
Kale, R., No liquid holding recovery for chromosomal aberrations or sister-chromatid exchanges in irradiated G_1 human lymphocytes, 10:11683 (J;NL)
Kalman, J.R., *See* Shibaoka, M., 10:10858
Kanazawa, T., Ammonia regulation of intermediary metabolism in photosynthesizing and respiring Chlorella pyrenoidosa: comparative effects of methylamine, 10:11695 (J;JP)
Kaneko, H., *See* Tajima, H., 10:11252
Kang, H.S., Perturbation theory of classical equilibrium fluids, 10:11922 (J;US)
Kansa, E.J., *See* Koopman, R.P., 10:11598
Kanter, I.E., Research and development for advanced combined NO/sub x// SO_2 removal systems. Technical progress report, 10:10868 (R;US)
Research and development for advanced combined NO/sub x//SO_2 removal systems. Technical progress report No. 15, October 29, 1984-November 30, 1984, 10:10869 (R;US)
Kapustinsky, J.S., *See* DiGiacomo, N.J., 10:11870
Karas, B.R., *See* Baumgartner, C.E., 10:11278
Karger, F., *See* Becker, G., 10:11933
Kartawijaya, A.S., *See* Burdon, R.G., 10:10916
Kasuga, Y., *See* Nagata, S., 10:11270
Kataoka, T., Dislocation charges in pure and Ca^{++}-doped KCl in the temperature range from 82 to 294 K, 10:11426 (J;GB)
Kato, K., Nonlinear wavelength conversion techniques for laser light harmonic generation by new nonlinear optical crystals, 10:11504 (TJ;US)
Katzenellenbogen, J.A., *See* Kiesewetter, D.O., 10:11660
Kauffman, R.L., *See* Matthews, D.L., 10:11499
Kaufman, A., *See* Brand, M.J., 10:11258
See Buchanan, W., 10:11231
Kaun, T.D., *See* Smith, J.L., 10:11237
Kazimi, M.S., *See* Piet, S.J., 10:11990
Keller, O.L. Jr., Frontiers of chemistry for americium and curium, 10:11473 (R;US)
Kellogg, G.L., Initial stages of oxide formation on rhodium field emitters, 10:11358 (J;US)
Kelly, B.A., Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 15, Appendix P: waste management, 10:11205 (R;US)
Kelly, B.T., *See* Green, W.V., 10:11422
Kelly, C.C., *See* Crampton, L.S.W., 10:11189
Kelmers, A.D., Progress in evaluation of radionuclide geochemical information developed by DOE high-level nuclear waste repository site projects. Report for January-March 1984, 10:11001 (R;US)
See Seeley, F.G., 10:11003
Kemp, N.H., *See* Wilemski, G., 10:11276
Kenefick, R.A., *See* Glass, G., 10:11829
Kennedy, A.D., Where is the continuum in lattice quantum chromodynamics?, 10:11858 (J;US)
Kennel, C.F., *See* Scarf, F.L., 10:11753
Kent, A.C., *See* Chen, J.W., 10:10832
Kerchner, H.R., *See* Sekula, S.T., 10:11330
Kerkhoff, H.G., *See* Lindle, D.W., 10:11789
Kerley, G.I., Model for the calculation of thermodynamic properties of a fluid: using hard-sphere perturbation theory and the zero-Kelvin isotherm of the solid, 10:11808 (J;US)
Kern, R.D., Identification and temporal behavior of radical intermediates formed during the combustion and pyrolysis of gaseous fuels: kinetic pathways to soot formation. Progress report, September 1, 1982-June 30, 1985, 10:11475 (R;US)
Kerner, W., *See* Pao, Y., 10:11955
Kerrisk, J.F., *See* Ogard, A.E., 10:11000
Kershner, C.J., Low jitter trigger for an excimer laser, 10:11497 (R;US)
Kerslick, G., *See* Anselmo, A., 10:11535
Kerstein, A.R., Scaling theory of desorption from molecular-sieve materials, 10:11919 (J;US)
Kessler, J.H., *See* Kelmers, A.D., 10:11001
Kestin, J., Geometric analysis of the solutions of two-phase flows: two-fluid model, 10:11802 (R;US)
Viscosity of carbon-monoxide mixtures with four gases in the temperature range 25-200°C: supplement, 10:11465 (J;DE)
Ketelle, R.H., Site characterization of the West Chestnut Ridge site, 10:10977 (R;US)
See Pin, F.G., 10:11002
Key, T.S., *See* Bower, W.I., 10:11045
See Stevens, J.W., 10:11048
Keye, M., *See* Buckingham, M.J., 10:10889
Khuri, N.N., *See* Beg, M.A.B., 10:11839
Kielczewska, D., *See* Park, H.S., 10:11828

Kiesewetter, D.O., Preparation of four fluorine-18-labeled estrogens and their selective uptakes in target tissues of immature rats, 10:11660 (J;US)
Kilbourn, M.R., *See* Kiesewetter, D.O., 10:11660
Kilgallon, A., *See* Scaife, P.H., 10:10890
Killand, B.W., *See* Loscutoff, S.M., 10:10933
Killion, M.E., *See* Muscatello, A.C., 10:10986
Kim, J.S., Absolute minimum of Landau's thermodynamic potential, 10:11907 (J;US)
Kim, S., Low-temperature ion beam mixing of Pt and Si markers in Ge, 10:11416 (J;US)
Kimball, C.W., Studies of structural properties and their relationship to critical parameters in superconducting materials. Final report 1 October 1979-31 December 1983, 10:11912 (R;US)
King, D.L., Characterization of performance loss mechanisms in a concentrating photovoltaic module, 10:11034 (RA;US)
Solar spectrum influence on the annual performance of AlGaAs/Si stacked cells, 10:11033 (RA;US)
King, D.S., NO thermally desorbed from a saturation coverage on Pt(111): Internal state distributions, 10:11445 (J;US)
King, D.W., Effect of timeliness and comprehensiveness on value. Volume 3, 10:12029 (RA;US)
Study of the value of information and the effect on value of intermediary organizations, timeliness of services and products, and comprehensiveness of the EDB. Volume 1, Volume 2, and Volume 3, 10:12026 (R;US)
Value of libraries as an intermediary information service. Volume 1, 10:12027 (RA;US)
King, J.M., Progress in on-site fuel cell technology development, 10:11233 (RA;US)
King, N.S.P., *See* Ullmann, J.L., 10:11878
King, R.J., *See* Burke, G.J., 10:11521
Kinser, W.H., Heavy-Ion Reactions: a current awareness bulletin, 10:11863 (R;US)
Kipp, J.A., Conceptual model of groundwater flow in the Eastern Kentucky coal field, 10:10904 (RA;US)
Kipp, M.E., *See* Grady, D.E., 10:11478
Kirchhoefer, H., Investigation of the isothermal precipitation behaviour of nickel-base alloys using electrochemical phase extraction, 10:11340 (R;DE;In German)
Kirchner, R., Intense beams of mass-separated, neutron-deficient indium, tin and lead isotopes, 10:11547 (R;DE)
Kirk, P.N., Experiments on the TASS and HISS spectrometers at the Bevalac. Annual progress report, April 1, 1984-March 31, 1985, 10:11875 (R;US)
Kirschfink, F.J., *See* Althoff, M., 10:11818
Kishida, K., Development of PAFC system and its application to industrial use, 10:11253 (RA;US)
R and D of phosphoric acid fuel cell technologies and systems for a dispersed power plant, 10:11266 (RA;US)
Kitchings, J.T., Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 16, Appendix Q: wildlife management, 10:11206 (R;US)
Klausmeier, W.H., Biomass chemical production by thermochemical conversion, 10:11040 (J;US)
Klecker, B., *See* Scholer, M., 10:11751, 10:11757
Klein-Szanto, A.J.P., *See* Shiba, M., 10:11699
Kleinhofs, A., *See* Arenaz, P., 10:11698
Klepper, E.L., Rooting depth and distributions of deep-rooted plants in the 200 Area control zone of the Hanford Site, 10:11665 (R;US)
Klepper, O., *See* Kirchner, R., 10:11547
Kleven, B.E., *See* Canada, D.C., 10:11429
Klinzing, G.E., *See* Morsi, B.I., 10:10912
Klose, P.N., Summary of environmental impact assessment studies at the Vienna fly-ash disposal site. Final report, 10:10870 (R;US)
Klubek, B., Removal of organic sulfur from microbial coal (bacterial degradation of sulfur containing heterocyclic compounds), 10:10834 (RA;US)
Klyosov, A.A., Enzymatic conversion of cellulosic materials to sugars and alcohol: the technology and its implications, 10:11022 (R;AT)
Knies, G., *See* Bartel, W., 10:11814, 10:11817
Knights, J.C., Physics of VLSI, 10:11522 (B;US)
Knoepfle, K.T., *See* Griffioen, K.A., 10:11885
Knoke, G.S., *See* Case, G.D., 10:10867
Knott, A.C., *See* Rigby, G.R., 10:10857
Kobayashi, M., 4.5 MW fuel cell power plant test at Tokyo Electric Power Company, 10:11240 (RA;US)
Kobrin, P., *See* Lindle, D.W., 10:11789
Kochanski, T.P., *See* Snipes, J.A., 10:11931
Kocher, D.C., *See* Ward, R.C., 10:11608
Koczan, S.P., *See* Suazo, G., 10:11485
Kodama, T., Status of Japanese molten carbonate fuel cell program, 10:11269 (RA;US)
Kodres, C.A., *See* Phillips, P.J., 10:11072
Kogan, V.G., Eilenberger equations for moderately dirty superconductors, 10:11916 (J;US)
Koll, J.H., Quality assurance in the fabrication of natural uranium nuclear fuels, 10:10961 (RA;DE;In Spanish)
Komori, A., Observations of low-frequency plasma fluctuations in the Elmo Bumpy Torus, 10:11958 (J;AT)
Kondal Rao, N., *See* Balaramamoorthy, K., 10:11110
Konitzer, D.G., Comparison of the microstructures of as-cast and laser surface melted Ti-8Al-4Y, 10:11366 (J;US)
Koopman, R.P., Results of recent large-scale NH_3 and N_2O_4 dispersion experiments, 10:11598 (R;US)
Kopp, O.C., *See* Harris, L.A., 10:11616
Korschinek, G., *See* Ziegler, N.F., 10:11530
Koseff, J.R., Mixing in a stratified recirculating flow, 10:11508 (R;US)
Three-dimensional lid-driven cavity flow: experiment and simulation, 10:11506 (R;US)
Koshlap, K., *See* Meyer, B., 10:11603
Koslowsky, V.T., *See* Kirchner, R., 10:11547
Kozlu, H., *See* Louis, J.F., 10:11525
Krabiel, H., Possibilities of heat recovery in induction heating and melting, 10:11313 (TG;GB)
Kraichnan, R.H., Intermittency and attractor size in isotropic turbulence, 10:11805 (J;US)
Krakowski, R.A., *See* Stacey, W.M., 10:11989
Krall, J.F., *See* Seyler, C.E., 10:11968
Krall, N.A., *See* McBride, J.B., 10:11948
Kramer, S.D., *See* Hurst, G.S., 10:11736
Krankota, J.L., Mechanical properties of electrodeposited nickel and copper, 10:11348 (R;US)
Kranz, R.L., Permeability changes during time-dependent deformation of silicate rock, 10:10996 (J;US)
Krause, H.F., *See* Rosseel, T.M., 10:11762
Kraushaar, J.J., *See* Ullmann, J.L., 10:11878
Krauss, M., Application of quantum chemistry of atmospheric chemistry. Annual report, 1 October 1983-30 September 1984, 10:11438 (R;US)
Krehbiel, H., *See* Bartel, W., 10:11814, 10:11817
Kresin, V., Superconducting junction with resonant tunneling, 10:11913 (R;US)
Krishnan, T.S., *See* Balaramamoorthy, K., 10:11110
Kropp, W.R., *See* Park, H.S., 10:11828
Krueger, R.J., *See* Beezley, R.S., 10:11861
Kruer, W.L., J x B heating by very intense laser light, 10:11949 (J;US)
See Estabrook, K., 10:11952
Krupp, W.E., Electron microprobe analysis of irradiated S8ER cladding, 10:11114 (R;US)
Ku, J.K., *See* Inoue, G., 10:11792
Ku, J.Y., *See* Ward, R.C., 10:11608
Kuehl, T., *See* Kirchner, R., 10:11547
Kukla, G.J., Variation of Arctic cloud cover in summer, 10:11586 (R;US)
Kulcinski, G.L., New challenges in fusion research for the materials scientist, 10:11995 (BA;GB)
Kulkarni, P.G., *See* Balaramamoorthy, K., 10:11110
Kunz, H.R., *See* Meyer, A.P., 10:11236
Kunz, K.H., *See* Weidinger, H.G., 10:11105
Kurnit, N.A., Optical pumping in a whispering mode optical waveguide, 10:11502 (P;US)
Kuti, J., *See* Kennedy, A.D., 10:11858
Kuuskraa, V.A., Replacement cost of domestic crude oil, 10:10940 (R;US)
Kwak, J.F., Transport studies of several novel organic conductors, 10:11915 (R;US)
See Azevedo, L.J., 10:11411

L

La Sala, R., Geothermal research and development activities of the U.S. Department of Energy, 10:11225 (BA;NZ)

Laats, E.T., FRAP-T5 uncertainty study of five reactor transient and accident events, 10:11150 (R;US)
LaBombard, B., *See* Lipschultz, B., 10:11964
Lacelle, S., Applications of NMR to the dynamics of carbohydrates; simplifying NMR spectra of proteins, 10:11641 (R;US)
Lackey, J.G., Comprehensive, integrated, remote sensing at DOE sites, 10:11624 (R;US)
Lagarde, P., *See* Comin, F., 10:11417
Laguna, G., *See* Lyman, J.L., 10:11469, 10:11470
Lalvani, S.B., Desulfurization of coal slurries by electrolysis, 10:10909 (RA;US)
Lamont, J., Proceedings: parallel processing for power system planning and operations, 10:11066 (R;US)
Lance, E.D., *See* Corbett, B.L., 10:11136
Lander, G.H., Magnetization density of 5f electrons in ferromagnetic PuSb, 10:11361 (J;US)
Landman, L.C., *See* Wagner, R.D., 10:11319
Landsman, S.D., *See* Nelson, D.A., 10:11463
Landvatter, S.W., *See* Kiesewetter, D.O., 10:11660
Lang, H.A., Seismic stress fields for nuclear elbows using toroidal elasticity theory, 10:11121 (R;US)
Langguth, W., Monte Carlo calculation of hadron masses with light dynamical quarks, 10:11835 (R;DE)
Lankford, A., *See* Briggs, D., 10:11569
Lankford, A.J., *See* Brafman, H., 10:11554
Larkins, F.P., *See* Jackson, W.R., 10:10847
Larsen, J.C., *See* Rinsland, C.P., 10:11589
Larson, B.C., Overheating and undercooling in silicon during pulsed laser irradiation, 10:11405 (R;US)
See Tischler, J.Z., 10:11329
Larson, D.B., Explosive-induced wave propagation in nugget sandstone, 10:11728 (J;US)
Larson, T.K., Testing and analysis of the Semiscale Mod-1 heater rod design, 10:11141 (R;US)
Larsson, P.O., *See* Kirchner, R., 10:11547
Later, D.W., Integrated analytical approach to detailed chemical characterization of coal liquefaction process materials, 10:10861 (R;US)
See Chess, E.K., 10:10862
Latzel, G., *See* Gruber, K., 10:11083
Lau, C.W., *See* Argon, A.S., 10:11332
Laub, A.J., Algorithms and software for pole assignment and observers, 10:11929 (R;US)
Lavoie, P.A., *See* Tapping, R.L., 10:11007
Lawrence, F.W., *See* Kipp, J.A., 10:10904
Lazarus, E.A., *See* Bell, J.D., 10:11965
Leaf, G.K., *See* Vanka, S.P., 10:11803
Learned, J.G., *See* Park, H.S., 10:11828
Lebrun, D., *See* DiGiacomo, N.J., 10:11870
Lechtenfeld, O., Stochastic variables in N=1 supersymmetric Yang-Mills theory, 10:11852 (R;DE)
Lee, C.S., *See* Kang, H.S., 10:11922
Lee, D.K., *See* Uckan, N.A., 10:11980
Lee, D.W., *See* Pin, F.G., 10:11002
Lee, J.M., Electric utility PAFC technology development progress, 10:11241 (RA;US)
Lee, M.L., Identification of polycyclic aromatic compounds containing two heteroatoms in coal liquids and shale oils. Incremental funding request and annual progress report, December 1, 1983-November 31, 1984, 10:10850 (R;US)
See Pelroy, R.A., 10:11702
Lee, M.T., Evaluation of existing data on discharges from active coal mines in Illinois, 10:10884 (RA;US)
Lee, R.W., *See* Rosen, M.D., 10:11498
Lee, S.K., Tensile and stress rupture tests of S8DR Hastelloy-N heats: ORNL verification tests, 10:11344 (R;US)
Lee, S.Y., *See* Kelmers, A.D., 10:11001
See Rothschild, E.R., 10:11625
Lee, Y.T., *See* Pollard, J.E., 10:11788
Lefort, M., *See* Jacquet, D., 10:11886
Legendre, E., Application of the heat pump for concentration by evaporation and for drying in agricultural foodstuffs industries, 10:11312 (TG;GB)
Leger, W., *See* Stieglitz, L., 10:11437
Lehmann, E., *See* Park, H.S., 10:11828
Leigh, R.W., Cost-based rates and other conservation options for electric utilities, 10:11217 (RA;US)
Potential of building electricity systems for load reduction and load levelling, 10:11284 (RA;US)
Leith, D.W.G.S., *See* Williams, S., 10:11570
Lekach, S.V., *See* Diamond, D.J., 10:11138
Lengyel-Frey, D., Fundamental and harmonic emission in interplanetary type 2 radio bursts, 10:11743 (R;US)
Leon, M., *See* Boekema, C., 10:11394
Leow, H.M., *See* Shibaoka, M., 10:10858
Lepping, R.P., *See* Tsurutani, B.T., 10:11758
Lerner, J.L., *See* Mantl, S., 10:11382
Lester, T.W., *See* Chowdhury, D.P., 10:11807
Lesuer, D.R., *See* Trusty, R.M., 10:11488
Leung, L., *See* Scaife, P.H., 10:10890
Leventhal, J.J., Low energy ion-neutral collisions. Progress report, June 1, 1984-May 31, 1985, 10:11766 (R;US)
Leventouri, T., *See* Sekula, S.T., 10:11330
Levine, D., Spot and futures markets for natural gas, 10:10946 (R;US)
Levy, J.M., *See* Beer, J.M., 10:11013
Lew, H.G., Coal water mixture combustion in Multiannular Swirl Burner (MASB). Low Emission Combustor Technology Program. Draft, 10:10924 (R;US)
Lewis, P.S., Hardware description languages for systolic architectures, 10:12013 (R;US)
Lewis, S.E., *See* Popp, R.A., 10:11691
Li, A.P., *See* Zamora, P.O., 10:11697
Li, J.C.M., *See* Kataoka, T., 10:11426
Liao, C., Study of the symmetric charge transfer reaction $H^+_2 + H_2$ using the high resolution photoionization and crossed ion—neutral beam methods, 10:11791 (J;US)
See Liao, C., 10:11791
Lichti, R.L., *See* Boekema, C., 10:11394
Lidsky, L.M., *See* Piet, S.J., 10:11990
Lietzke, D.A., *See* Rothschild, E.R., 10:11625
Light, J.C., *See* Wong, C.F., 10:11797
Likens, G.E., *See* Galloway, J.N., 10:11600
Lin, S.Y., *See* Lucovsky, G., 10:11036
Lince, J.R., Electron localization and superconductivity of very thin epitaxially grown Ag films on Ge(001). Technical report, 10:11324 (R;US)
Lindau, I., *See* Tatchyn, R., 10:11574
Lindberg, R.G., *See* Skiles, D.D., 10:11716
Lindemer, T.B., *See* Besmann, T.M., 10:11440
Lindemeyer, C.W., Locking mechanism for indexing device, 10:11489 (P;US)
Lindle, D.W., Nitrogen K-shell photoemission and Auger emission from N_2 and NO, 10:11789 (J;US)
Lindstrom, P., *See* Gould, H., 10:11551
Linn, S.H., Photoionization study of HgAr, 10:11770 (J;US)
Linville, B., Contracts for field projects and supporting research on enhanced oil recovery. Progress Review No. 39, quarter ending June 30, 1984, 10:10935 (R;US)
Lipkin, H.J., Monoponucleosis: the wonderful things that monopoles can do to nuclei if they are there, 10:11832 (R;US)
Lippincott, E.P., LWR Pressure Vessel Surveillance Dosimetry Improvement Program. Semiannual progress report, October 1983-March 1984. Volume 1, 10:11088 (R;US)
Lipschultz, B., Marfe: an edge plasma phenomenon, 10:11964 (J;AT)
Litt, R.D., Update on operating performance of the Battelle Multisolid Fluidized-Bed Combustion process, 10:10920 (R;US)
Little, R., *See* Conn, R.W., 10:11993
Liu, C.T., Ductile ordered intermetallic alloys, 10:11363 (J;US)
Liu, K., *See* Hall, G., 10:11790
Liu, K.F., Research in theoretical nuclear physics. Progress report, February 1, 1984-October 31, 1984, 10:11888 (R;US)
Liu, Y.Y., Microstructural examination of fast-neutron irradiated Li_2O, 10:11390 (R;US)
Livesey, J.C., Chemical protection against ionizing radiation. Final report, 10:11676 (R;US)
Loar, J.M., Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 2, Appendix A: aquatic habitats, 10:11192 (R;US)
Lobkowicz, F., *See* Collick, B., 10:11831
Lock, S., Inhalation toxicology of diesel fuel obscurant aerosol in Sprague-Dawley rats. Final report, Phase 3, subchronic exposures, 10:11687 (R;US)
Loeb, L.A., *See* Das, S.K., 10:11692
Loken, M.C., *See* Osnes, J.D., 10:11723
Longest, A.W., *See* Petrykowski, J.C., 10:11156
Loong, C.K., Neutron scattering investigation of magnetic excitations at high energy transfers, 10:11389 (R;US)
Lopez, N., *See* Jory, H., 10:11973
Lorenz, R.A., *See* Collins, J.L., 10:11157
Loscutoff, S.M., Pulmonary toxicity of inhaled coal liquid aerosols (boiling range 230-450°C), 10:10933 (J;US)
LoSecco, J.M., *See* Park, H.S., 10:11828

Loth, J.L., Darrieus rotor with forward tilting blade speed control, 10:11064 (J;US)
Lott, D.F., *See* Verosub, K.L., 10:11717
Louis, J.F., Study of deposition control using transpiration. Technical progress report, 10:11525 (R;US)
Loveland, W., *See* Dersch, G., 10:11873
Lowdermilk, W.H., *See* Rainer, F., 10:11424
Lowndes, D.H., Time-resolved studies of rapid solidification in highly undercooled molten silicon, 10:11406 (R;US)
Lucovsky, G., Compensation of dangling bonds in A-Si, Ge:H alloys. Annual report, 10:11036 (R;US)
Luebelsmeyer, K., *See* Althoff, M., 10:11818
Lund, T., *See* Dersch, G., 10:11873
Lunsford, RV., *See* Foster, C.A., 10:12002
Luoma, W.L., *See* Breault, R.D., 10:11275, 10:11277
Luttrell, G.H., *See* Yonn, R.H., 10:10911
Lyman, J.L., Reactions of methyl and ethyl radicals with uranium hexafluoride, 10:11470 (J;US)
Reactions of uranium hexafluoride photolysis products, 10:11469 (J;US)
Lynch, V.E., *See* Holmes, J.A., 10:11953
Lynn, K.G., *See* Chen, D.M., 10:11761
See Schultz, P.J., 10:11760
Lynnworth, L.C., *See* Miller, G.N., 10:11090
Lyon, J.G., *See* Fedder, J.A., 10:11733
Lytle, J.E., CG-DAR-1: Guide to the declassified areas of nuclear energy research, 10:12024 (R;US)

M

Macal, C.M., *See* Hanson, D.A., 10:11184
Macario, A.J.L., Antigenic fingerprinting of methanogenic bacteria with polyclonal antibody probes, 10:11662 (J;DE)
See Demacario, E.C., 10:11661
MacCracken, M.C., Effects of interactive transport and scavenging of smoke on the calculated temperature change resulting from large amounts of smoke, 10:11597 (R;US)
MacDicken, K.G., *See* Brewbaker, J.L., 10:11223
MacDonald, J.P., *See* Stonehart, P., 10:11263
MacDonald, P.E., *See* Broughton, J.M., 10:11152
See McCardell, R.K., 10:11151
MacGowan, B., *See* Rosen, M.D., 10:11498
MacGowan, B.J., *See* Matthews, D.L., 10:11499
Machanoff, R., *See* Adler, H.I., 10:11663
Maciel, G.E., NMR studies of fossil fuels. Final technical report, 10:10853 (R;US)
Macip, M.A., *See* Brostow, W., 10:11379
Macklin, R.L., Resonance neutron capture by ^{39,41}K, 10:11872 (J;US)
Madariaga, H.A., Energy conservation by on-site fuel cells, 10:11232 (RA;US)
Madey, R., *See* Huang, J.C., 10:11435
Magelssen, G., *See* Miley, G., 10:11997
Maggiore, C., *See* Mathez, E.A., 10:11721
Maggiore, C.J., *See* Srinivasan, S., 10:11262
Mahlum, D.D., *See* Loscutoff, S.M., 10:10933
Mainka, E., Chemical assay as an element of quality control of light water fuels, 10:11085 (RA;DE)
Major, T.C., *See* Revis, N.W., 10:11707
Makdisi, Y., *See* Collick, B., 10:11831
Makynen, J.M., *See* Strom, L., 10:11131
Malinauskas, A.P., *See* Campbell, D.O., 10:11143
Mallett, C.W., Stability of spoil piles and highwalls in deep surface mines, 10:10900 (R;AU)
Manca, J., *See* Jory, H., 10:11973
Manley, B.W., Comparative sinterability of combustion synthesized and commercial titanium carbides, 10:11393 (R;US)
Manrod, W.E., *See* Petrich, C.H., 10:11197
Mansfield, D.K., *See* Goree, J., 10:11944
Mantell, D.A., *See* King, D.S., 10:11445
Mantl, S., Tracer diffusion of Ge in Ni single crystals, 10:11382 (J;GB)
March-Leuba, J., *See* Upadhyaya, B.R., 10:11091
Marchand, R., Laser-beam cleaning in a plasma compressor, 10:11984 (J;US)
Marchok, A.C., *See* Shiba, M., 10:11699
Marini, A., *See* Fernandez, E., 10:11827
Marmar, E.S., *See* Lipschultz, B., 10:11964
See Rice, J.E., 10:11959
Marr, D.R., *See* Alcouffe, R.E., 10:11899
Marriner, J., *See* Simpson, J., 10:11536
Marshak, M.L., *See* Collick, B., 10:11831
Marshall, T.C., *See* Zamora, P.O., 10:11697
Martin, F.M., *See* Hakkinen, P.J., 10:11693
Martin, O., Reducing the number of flavors in the microcanonical method, 10:11857 (J;US)
Martin, R., *See* Miley, G., 10:11997
Martinis, J.M., Macroscopic quantum tunnelling in a current biased Josephson junction, 10:11914 (R;US)
Martinson, Z.R., *See* McCardell, R.K., 10:11151
Martyn, H.U., *See* Althoff, M., 10:11818
Maru, H.C., *See* Anderson, J.M., 10:11251
See Paetsch, L., 10:11235
Marx, D., *See* Kirchner, R., 10:11547
Marx, M.D., D0 Project at Fermilab, 10:11543 (R;US)
Preliminary results on neutrino proton elastic scattering, 10:11819 (R;US)
Maskarinec, M.P., *See* Francis, C.W., 10:11190
Masker, W.E., *See* Dodson, L.A., 10:11689
Massoth, F.E., Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 1, October-December 1983, 10:11458 (R;US)
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 4, July-September 1984, 10:11459 (R;US)
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 3, April-June 1984, 10:11460 (R;US)
Masterson, T.G., *See* Ullmann, J.L., 10:11878
Masunaga, N., *See* Akimaru, S., 10:11267
Matachek, J.R., Synthesis and reactivity of heterodinuclear iron, ruthenium, and cobalt compounds containing bridging dithiomethylene ligands. Attempted synthesis of the iron carbyne compound $Cp(CO)FeCSCH_3$, 10:11461 (R;US)
Matalucci, R.V., *See* Molecke, M.A., 10:10990
Mathez, E.A., Carbon abundances in mantle minerals determined by nuclear reaction analysis, 10:11721 (J;US)
Matlack, G.M., Rapid and precise alpha-particle spectrometry for plutonium materials, 10:11432 (J;NL)
Matos, J.E., *See* Woodruff, W.L., 10:11159
Matsumura, M., *See* Bharvani, R., 10:11234
Mattas, R.F., *See* Liu, Y.Y., 10:11390
Matthews, D.L., Demonstration of a soft x-ray amplifier, 10:11499 (J;US)
See Rosen, M.D., 10:11498
Matzke, H., *See* Weber, W.J., 10:10981
Mauel, M.E., *See* Sevillano, E., 10:11930
May, E.N., *See* Dawson, J.W., 10:11558
Maya, L., Electrodeposition of Neptunium(V) films on noble metal electrodes, 10:11474 (J;DE)
Mazumdar, S., *See* Campbell, D.K., 10:11906
McAuliffe, M.J., *See* Hall, G., 10:11790
McBride, J.B., Stabilization of interchange modes in mirror plasma devices by radio-frequency sideband coupling, 10:11948 (J;US)
McCardell, R.K., Damage and failure of previously irradiated fuel rods during a reactivity initiated accident, 10:11151 (R;US)
McCardle, J., *See* Binnie, D.M., 10:11557
McCarthy, J.F., Simple, inexpensive apparatus for rotating bottles during zooplankton feeding experiments, 10:11629 (J;NL)
McClellan, R.O., *See* Zamora, P.O., 10:11697
McCloskey, M.W., *See* Breault, R.D., 10:11275, 10:11277
McCluney, R., *See* Block, D.L., 10:11050
McComas, D.J., *See* Gosling, J.T., 10:11756
See Hones E.W. Jr., 10:11752
McCorkle, R.A., Capillary discharge thermonuclear burner, 10:11972 (J;IT)
McCreary, W.J., *See* Springer, R.W., 10:11768
McDonald, J.C., *See* Wilson, W.E., 10:11901
McDonald, J.F., *See* South, D.W., 10:11219
McDowell, W.J., Investigations of ion-size-selective synergism in solvent extraction, 10:11433 (J;US)
See McKlveen, J.W., 10:11572
McElroy, J.F., Status of solid polymer electrolyte fuel cell technology, 10:11260 (RA;US)
McElroy, W.N., *See* Lippincott, E.P., 10:11088
McEnerney, J.W., *See* Foulds, J.R., 10:11370
McFadden, J.H., *See* Peterson, C.E., 10:11174, 10:11175
McFarland, R.H., *See* Tanis, J.A., 10:11781

McGaughey, P.L., *See* DiGiacomo, N.J., 10:11870
McGlade, M.J., *See* Heisig, V., 10:11642
McGrail, B.P., Hydrothermal waste package interactions with methane-containing basalt groundwater, 10:10983 (R;US)
McHargue, C.J., Structure and properties of ion-implanted Al_2O_3, 10:11388 (R;US)
McKlveen, J.W., Liquid scintillation alpha spectrometry techniques, 10:11572 (J;NL)
McKown, H.S., Thermal ion source for quadrupole mass spectrometers, 10:11579 (J;NL)
McLain, R., *See* Frome, E.L., 10:11927
McLean, A.G., *See* Arnold, P.C., 10:10918
McLean, E.T., *See* Kalchthaler, R.F. Jr., 10:10871
McLean, R., Gastropod shells: a dynamic resource that helps shape benthic community structure, 10:11630 (J;NL)
McLellan, E.J., Reinjection laser oscillator and method, 10:11505 (P;US)
McLerran, L., Probes of the quark-gluon plasma as it might be produced in ultra-relativistic nuclear collisions, 10:11889 (R;US)
McManamy, T.J., *See* Uckan, N.A., 10:11981
McNeil, M.B., *See* Dils, R.R., 10:11391
McPherson, G.D., Review of experiments to evaluate the ability of electrical heater rods to simulate nuclear fuel rod behavior during postulated loss-of-coolant accidents in light water reactors, 10:11142 (R;US)
McRae, T.G., *See* Koopman, R.P., 10:11598
McShane, M.C., *See* Thomas, J.M., 10:11618
McWilliams, R., *See* Olson, L., 10:11967
Meachum, T.R., Comparison of mass flow calculations using drag disc/turbine transducer (DTT) data from the Transient Flow Calibration Facility, 10:11146 (R;US)
Meadows, J.W., *See* Poenitz, W.P., 10:11882
Medecki, H., *See* Matthews, D.L., 10:11499
Medley, S.S., Fusion gamma diagnostics, 10:11943 (R;US)
Meechan, P.J., Delayed inhibition of subchromosomal DNA synthesis in V-79 Chinese hamster cells after γ irradiation, 10:11679 (J;US)
Subchromosomal DNA synthesis in synchronous V-79 Chinese hamster cells after x irradiation, 10:11678 (J;US)
Meek, C.C., Use of Kalman filter methods in analysis of in-pile LMFBR accident simulations, 10:11113 (J;US)
Meerkov, S.M., *See* Bellman, R., 10:12023
Mehlhorn, T.A., UPEML: a machine-portable CDC Update emulator, 10:11902 (R;US)
Mehrotra, B.N., Effect of heat treatment temperature (HTT) on density, weight and volume of glass-like carbon (GC), 10:11425 (J;GB)
Mehta, M.V., Existing technology transfer report dissolver cold-flow modelling, 10:10836 (R;US)
Meier, W.R., *See* Monsler, M.J., 10:11998
Meinke, R., *See* Bartel, W., 10:11814, 10:11817
Meissner, K., *See* Bartel, W., 10:11814
Mellea, B.C., Effectiveness of regional committees in implementing regional resource recovery programs, 10:11314 (R;US)
Mellinger, G.B., *See* Daniel, J.L., 10:10980
Mendel, J.E., Purpose of the Materials Characterization Center, 10:10982 (R;US)
Menke, W., Horizontal propagation of P waves through scattering media: analog model studies relevant to long-range P/sub n/ propagation, 10:11722 (J;US)
Menovsky, A., *See* Willis, J.O., 10:11357
Merklin, J.F., *See* Chowdhury, D.P., 10:11807
Meron, M., Investigations of molecular orbitals with accel-decel beams, 10:11759 (R;US)
See Johnson, B.M., 10:11538
Mertens, V., Use of MC68000 microprocessors in the TASSO experiment, 10:11556 (R;DE)
Mertol, A., Transient, steady state and stability behavior of a thermosyphon with throughflow, 10:11068 (J;GB)
Merz, M.D., Test methods to predict long-term corrosion of container materials in repositories, 10:11345 (R;US)
Mesmer, R.E., *See* Holmes, H.F., 10:11454
Meyer, A.P., Status of molten carbonate fuel cell development at United Technologies Corporation, 10:11236 (RA;US)
Meyer, B., Comparison of wet and dry desiccator test methods for formaldehyde emission from UF-bonded wood products, 10:11603 (J;US)
Meyer, H.J., How dangerous are routine X-ray checkups, 10:11657 (R;DE;In German)
Meyer, J., *See* Behrend, H.J., 10:11815
Meyer, R.E., *See* Kelmers, A.D., 10:11001
Meyer, S., *See* Kennedy, A.D., 10:11858
Meyers, N., [Computerized control of grain drying operations]. Final technical report, 10:11669 (R;US)
Middendorf, M., Autoradiographical in-vitro examination of the cell proliferation of persisting psoriatic plaques in preferred areas under therapy with ultraviolet light: Photochemotherapy (PUVA) and selective ultraviolet phototherapy (SUP), 10:11654 (R;DE;In German)
Mientek, A.P., *See* Breault, R.D., 10:11275, 10:11277
Miksch, R.R., *See* Meyer, B., 10:11603
Mikula, P., *See* Carruthers, J., 10:10896
Milam, D., *See* Rainer, F., 10:11424
Miley, G., Inertial confinement fusion concepts for advanced fuels, 10:11997 (BA;GB)
Miley, G.H., *See* Hsiao, M.Y., 10:11966
See Welch, D.R., 10:11956
Miley, H.S., *See* Brodzinski, R.L., 10:11566
Millemann, R.E., *See* Ullrich, S.O. Jr., 10:11704
Miller, C.M., *See* Wolfsberg, K., 10:11740
Miller, D.G., *See* Binnie, D.M., 10:11557
Miller, D.M., Separation and fluorescence characterization of coal macerals , 10:10851 (RA;US)
Miller, E.K., *See* Burke, G.J., 10:11521
Miller, G.N., High temperature, high pressure water level sensor, 10:11090 (R;US)
Miller, J.F., *See* Cook, G.M., 10:11318
See Poa, D.S., 10:11179
Miller, R.A., *See* Loscutoff, S.M., 10:10933
Miller, R.L., *See* Uckan, N.A., 10:11982
Miller, T., Surface core-level shifts for Ge(100)-(2 x 1), 10:11375 (J;GB)
Miller, W.E., *See* Thomas, J.M., 10:11618
Mills, D.M., *See* Larson, B.C., 10:11405
See Tischler, J.Z., 10:11329
Milner, W.T., CHIL - a comprehensive histogramming language, 10:12009 (R;US)
Milora, S., *See* Greenwald, M., 10:11976
Milora, S.L., *See* Foster, C.A., 10:12002
Milton, K.A., *See* Bender, C.M., 10:11855
Minear, R.A., *See* Dickens, P.S., 10:10881, 10:10883
Minh, N.Q., Voltammetric study of the anodic oxidation of sulfide ions in molten fluorides, 10:11466 (J;US)
See Smith, J.L., 10:11237
Minkler, J.L., *See* Dillehay, L.E., 10:11646
Minner, D., DOE's Collins predicts need for 680 plants by 2000, 10:11315 (J;US)
Mirin, A.A., *See* Shestakov, A.I., 10:11985
Mishima, J., *See* Gore, B.F., 10:11168
See Sutter, S.L., 10:11612
Misuriello, H., Energy design of office buildings, 10:11298 (J;US)
Energy to recover, 10:11296 (J;US)
Misuriello, H.P., 168 proof?, 10:11295 (J;US)
Dwelling with energy, 10:11297 (J;US)
See Deringer, J.J., 10:11299
Mitchell, J.K., *See* Mostaghimi, S., 10:10885
Mitchell, T.M., *See* Davis, P.K., 10:10923
Miyasaka, K., *See* Hesketh, H.E., 10:10922
Mlotok, P., Indonesian oil and gas, 10:11216 (R;US)
Mobley, J.D., Recent advances in commercial organic-acid-enhanced FGD (flue gas desulfurization) systems. Report for September 1983-July 1984, 10:11527 (R;US)
Mokler, B.V., *See* Zamora, P.O., 10:11697
Molecke, M.A., Preliminary requirements for the emplacement and retrieval of defense high-level waste (DHLW) tests in the Waste Isolation Pilot Plant (WIPP), 10:10990 (R;US)
Molelekoa, M., Symmetries of gauge fields, 10:11860 (J;US)
Molton, P.M., *See* Nelson, D.A., 10:11463
Molvig, K., *See* Beasley, C.O., 10:11954
Monnet, F., *See* Jacquet, D., 10:11886
Monsler, M.J., Inertial fusion reactor studies at Lawrence Livermore National Laoratory, 10:11998 (BA;GB)
Montgomery, J.A. Jr., Solar-powered alcohol still. Final technical report, 10:11020 (R;US)
Monticelli, A., *See* Wu, F.F., 10:11071
Montvay, I., *See* Langguth, W., 10:11835

Moody, C.E. Jr., Model documentation for the mini-macroeconomic model: MINMAC, 10:11182 (R;US)
Moore, E.B., Control technology for radioactive emissions to the atmosphere at US Department of Energy facilities, 10:11611 (R;US)
Moore, J.S., *See* Rentz, R.L., 10:11248
Moore, S.R., Second-order corrections to the muon anomalous magnetic moment in alternative electroweak models, 10:11847 (J;US)
Moreno, S., *See* Misuriello, H., 10:11296
See Misuriello, H.P., 10:11295
Morford, G., *See* Vane, C.R., 10:11763
Morgan, T.J., *See* Tanis, J.A., 10:11781
Moriarty, J.A., H-Division materials physics quarterly report, April-June 1984, 10:11323 (R;US)
Morin, C., *See* Nury, J.C., 10:11126
Morra, F. Jr., *See* Kuuskraa, V.A., 10:10940
Morris, C.L., *See* Ullmann, J.L., 10:11878
Morrisseau, B., *See* Jalan, V., 10:11261
Morse, C.C., *See* Hakkinen, P.J., 10:11693
See Haschek, W.M., 10:11708
Morse, M.D., *See* Geusic, M.E., 10:11449
Morsi, B.I., LICADO process for super-clean coal. Quarterly report, October-December 1983, 10:10912 (R;US)
Moser, C.L., Decontamination and decommissioning of CPP-603 BIF filter room. Final report, 10:10993 (R;US)
Moser, D., *See* Meyer, H.J., 10:11657
Moser, W.S., Plutonium purification by vacuum distillation, 10:11347 (R;US)
Moses, G.A., *See* Uesaka, M., 10:11986
Mostaghimi, S., Erosion characteristics of surface-mined soils, 10:10885 (RA;US)
Moteff, J., *See* Foulds, J.R., 10:11370
Mothes, H., Dynamics and segregation of particles in a cyclone, 10:11523 (R;DE;In German)
Motley, R.W., *See* Olson, L., 10:11967
Moulder, J.F., *See* Hintz, M.B., 10:11380
Moure, R., *See* Savitz, D.A., 10:10939
Muchmore, C.B., *See* Chen, J.W., 10:10832
Muddle, B.C., *See* Konitzer, D.G., 10:11366
Mueller, H., *See* Duwe, R., 10:11108
Mueller, L.M., Commercial scale demonstration enhanced oil recovery by micellar-polymer flood. Technical progress report, November 1984, 10:10936 (R;US)
Mueller, U., *See* Schira, P., 10:11509
Muenzer, H., *See* Ziegler, N.F., 10:11530
Mulera, T.A., *See* Perez-Mendez, V., 10:11571
Muller, J.F., Evaluation and demonstration of the viability of salt bath solution heat treatment for D.U. penetrators. Final report, 10:11480 (R;US)
Munir, Z.A., Consideration of the role of sintering in gas-solid interactions, 10:11456 (J;NL)
Thermal decomposition of cadmium and cobalt carbonates, 10:11457 (J;US)
Munro, I.L., *See* Rothschild, E.R., 10:11625
Murakami, M., *See* Bell, J.D., 10:11965
Murata, K., *See* Kodama, T., 10:11269
Murch, G.E., Computer-simulated random-walk analysis of diffusion in dislocations, 10:11383 (J;CH)
Oxygen diffusion in uranium oxide: an overview, 10:11402 (J;CH)
See Sato, Hiroshi, 10:11333
Murgia, L.S., *See* Sheibley, D.W., 10:11256
Murphy, B.D., Treatment of ground deposition, species decay and growth and source height effects in a Lagrangian trajectory model, 10:11605 (J;GB)
Murphy, T., *See* Gielecki, M., 10:11074
Murray, D.F., Development of Northern Plant Documentation Center. Final report, 10:11664 (R;US)
Northern Plant Documentation Center, 1980-1983. Final report, 10:11615 (R;US)
Murray, W., *See* Gill, P.E., 10:12016
Muscatello, A.C., Americium transfer studies using hollow fiber/extractant membranes, 10:10986 (R;US)
Myers, J.P., Seasonal abundance and habitat use patterns of shorebirds at two sites in northern Alaska, 10:11640 (J;GB)

N

Naegeli, D.W., Engine wear with methanol fuel in a nitrogen-free environment. Interim report May-December 1983, 10:11320 (R;US)
Nagata, S., Development of high temperature solid electrolyte fuel cell at electrotechnical laboratory, 10:11270 (RA;US)
Nagesh, V.K., Wetting of nickel by silver, 10:11381 (J;GB)
Naidu, J.R., *See* Day, L.E., 10:11607
Nappo, C.J., *See* Clements, W.E., 10:11587
Naramoto, H., *See* McHargue, C.J., 10:11388
Narayan, J., *See* Pennycook, S.J., 10:11407
Naroska, B., *See* Bartel, W., 10:11817
Nath, S., *See* Glass, G., 10:11829
Nation, J.A., *See* Anselmo, A., 10:11535
Nauenberg, U., *See* Coteus, P., 10:11560
Nave, S.E., *See* Huray, P.G., 10:11378
Navratil, J.D., Americium-241: the most useful isotope of the actinide elements, 10:10957 (R;US)
See Moser, W.S., 10:11347
See Muscatello, A.C., 10:10986
See Schulz, W.W., 10:11464
Navvab, M., Daylighting data for atrium design, 10:11291 (R;US)
Ne'eman, E., Windows, skylights, and atria: occupants' visual/subjective comparison, 10:11316 (R;US)
Nead, R.L., *See* Muller, J.F., 10:11480
Neighbours, J.R., Radiation from intense electron beams associated with the Cherenkov mechanism. Technical report, 10:11897 (R;US)
See Buskirk, F.R., 10:11896
Nelson, C.B., *See* Murphy, B.D., 10:11605
Nelson, D.A., Formation of dimethylbenzenediol via acyloin condensation and a reduction-oxidation pathway, 10:11463 (R;US)
Nelson, J.L., Evaluation of alternative alloys for PWR steam generator tubing. Final report, 10:11096 (R;US)
Nelson, R.N., *See* Hersch, C.A., 10:11310
Nelson C.A. Jr., *See* Collick, B., 10:11831
Nemanich, R.J., *See* Biegelsen, D.K., 10:11037
Neskovic, O.M., *See* Berkowitz, J., 10:11450
Nester, K., *See* Thomas, P., 10:11610
Nestor, C.W. Jr., *See* Sobel, M., 10:11667
Neuer, H., Comparison of arthrography to clinical diagnostics for diagnosing meniscal lesions, 10:11656 (R;DE;In German)
Newbold, J.D., *See* Franco, P.J., 10:10886
Newby, D., Westinghouse fuel cell power plant design, 10:11242 (RA;US)
Newman, R.C., Correlation of acoustic and electrochemical noise in the stress-corrosion cracking of α-brass, 10:11377 (J;GB)
See Isaacs, H.S., 10:11325
Newman, S.M. Jr., Rapid and simple procedure for visualization of amphibian skeletons for teratological studies, 10:11666 (J;US)
Ng, C.Y., *See* Liao, C., 10:11791
See Linn, S.H., 10:11770
Ng, F.L., *See* Burdon, R.G., 10:10916
Nickel, H., *See* Kirchhoefer, H., 10:11340
Nicolet, M., *See* Kim, S., 10:11416
Nielsen, B., *See* Chen, D.M., 10:11761
Nielsen, T., Characterization of polycyclic organic matter (POM) from coal-fired power plants in the atmosphere and investigation of their transformation in the atmosphere, 10:10880 (R;DK;In Danish)
Niesen, V.G., *See* Wolfsberg, K., 10:11740
Nilan, R.A., *See* Arenaz, P., 10:11698
Nilson, F., *See* Holzer, R., 10:11100
Nimick, F.B., *See* Tillerson, J.R., 10:10989
Nishiyama, E., *See* Kishida, K., 10:11253
Nitschke, J.M., Application of alpha spectrometry to the discovery of new elements by heavy-ion beam bombardment, 10:11864 (J;NL)
Nix, C.E., *See* Waters, L.C., 10:11711
Noer, R.J., Josephson effect in $Lu_2Fe_3Si_5$: Evidence against triplet pairing, 10:11420 (J;US)
Nogar, N.S., *See* Wolfsberg, K., 10:11740
Norgren, D.U., Braking system for use with an arbor of a microscope, 10:11576 (P;US)
Norman, A.D., *See* Diel, B.N., 10:11471
Northcliffe, L.C., *See* Glass, G., 10:11829
Northrup, J.E., Predictions of the bond length and vibrational frequency of Ge_2, 10:11800 (J;NL)
Nowicki, L.J., *See* Mantl, S., 10:11382
Nury, J.C., Continuous inspection during fabrication, 10:11126 (RA;DE;In French)
Nuttall, A, *See* Williams, S., 10:11570

O

O'Brien, J.J., *See* Breault, R.D., 10:11275, 10:11277
O'Connell, R.F., Optimum method of analysis of Faraday rotation and ellipticity measurements in a metal-oxide-semiconductor system, 10:11910 (J;GB)
O'Dell, R.D., *See* Alcouffe, R.E., 10:11899

O'Gallagher, J.J., *See* Winston, R., 10:11057
O'Neill, J.P., *See* Heartlein, M.W., 10:11709
O'Neill, R.V., Parameter constraints in a stream ecosystem model: incorporation of a priori information in Monte Carlo error analysis, 10:11634 (J;NL)
O'Steen, W.N., Effects of coal mining on ground-water quality in West Virginia, 10:10882 (RA;US)
Oakberg, E.F., Effect of ethyl-, methyl- and hydroxyethyl-nitrosourea on the mouse testis, 10:11705 (J;NL)
Ogard, A.E., Groundwater chemistry along flow paths between a proposed repository site and the accessible environment, 10:11000 (R;US)
Ogilvie, K.W., Some contributions to knowledge of the magnetospheric plasma by ISEE investigators, 10:11749 (R;US)
Ogimoto, K., *See* Akimaru, S., 10:11267
Ogura, Y., Overview of fuel cell development under the Moonlight Project, 10:11265 (RA;US)
Ohno, Y., *See* Nagata, S., 10:11270
Ohshima, T., *See* Collick, B., 10:11831
Ojanen, M., Quality assurance and quality control requirements in nuclear fuel procurement in Finland, 10:10958 (RA;DE)
Oldfield, W., Between-heats charpy energy and initiation fracture toughness variation of SA533B-1, 10:11373 (J;US)
Curve fitting impact test data: a statistical procedure, 10:11515 (J;US)
Fitting curves to toughness data, 10:11514 (J;US)
Olinger, B., *See* Staudhammer, K.P., 10:11365
Olin, B.L., *See* Regan, J.D., 10:11701
Olsen, J., *See* Brafman, H., 10:11554
Olson, D.L., Looking for anomalons with a segmented Cerenkov detector, 10:11871 (R;US)
Olson, K.H., *See* Curtis, R.B., 10:11290
Olson, L., Coupling to the fast wave via a phased waveguide array, 10:11967 (J;AT)
Olsson, W.A., Dislocation model of the stress history dependence of frictional slip, 10:11726 (J;US)
Omelchenko, A.N., Further analysis of plasma bursts in high-latitude boundary layer of earth, 10:11748 (R;US)
Ong, E.T., *See* Camara, E.H., 10:11238
Ono, M., *See* Goree, J., 10:11944, 10:11946
See Skiff, F., 10:11945
Ono, S., *See* Akimaru, S., 10:11267
Onoshita, Toshio, *See* Tanaka, Akira, 10:10956
Osborne, M.F., *See* Collins, J.L., 10:11157
Osbourn, G.C., *See* Chaffin, R.J., 10:11031
Osetek, D.J., Hydrogen studies during PBF Severe Fuel Damage tests, 10:11145 (R;US)
Osnes, J.D., Expected repository environments in granite: thermal environment, 10:11723 (R;US)
Ossakow, S.L., *See* Satyanarayana, P., 10:11747
Ott, E., Effect of noise on time-dependent quantum chaos, 10:11923 (J;US)
Ott, H.R., Superconductivity in uranium compounds with Cu_3Au structure, 10:11355 (J;US)
Otto, S.W., *See* Martin, O., 10:11857
Owen, L.W., Magnetics, single-particle drift orbits, and nonresonant electron transport coefficients for the ELMO Bumpy Square, 10:11936 (RA;US)
See Hedrick, C.L., 10:11937
See Uckan, N.A., 10:11982
Owens, E.C. Jr., *See* Naegeli, D.W., 10:11320
Ozkan, U.S., Simple molybdate selective oxidation catalysts containing excess MoO_3 for C_4 hydrocarbon oxidation to maleic anhydride, 10:11462 (R;US)
Ozmat, B., *See* Argon, A.S., 10:11332

P

Paetsch, L., Component development for direct fuel cell, 10:11235 (RA;US)
Paffett, M.T., *See* Srinivasan, S., 10:11262
Paffrath, L., *See* Brafman, H., 10:11554
Pais, A., *See* Beg, M.A.B., 10:11839
Palmer, B.A., *See* Engleman R. Jr., 10:11793
Palmer, M.A., *See* Henke, B.L., 10:11575
Palmer, T.V., *See* Swenson, P.A., 10:11684
Pamidimukkala, K.M., *See* Kern, R.D., 10:11475
Panayotatos, P., Determination of the grain boundary recombination velocity in polycrystalline silicon as a function of illumination from photoconductance measurements, 10:11041 (J;GB)
Pancaccini, G., Fuel manufacturing follow at FRAGEMA, 10:10959 (RA;DE)
Pandich, T., Examination of the mineral components of coal and its resultant fly ash in relation to resistivity characteristics of the fly ash, 10:10855 (R;AU)
Pao, Y., Analytic theory of stable resistive magnetohydrodynamic modes, 10:11955 (J;US)
Pare, V.K., *See* Bell, J.D., 10:11965
Pareja, R., *See* Chen, D.M., 10:11761
Paretzke, H.G., *See* Wilson, W.E., 10:11901
Parisi, G., Some negative results for avoiding lattice fermionic doubling, 10:11844 (R;IT)
Staggered fermions and rotation-gauge invariance, 10:11843 (R;IT)
Park, H.S., Experimental limits on the nucleon lifetime for two- and three-body decay modes, 10:11828 (J;US)
Park, J.Y., Quantitative study of vacancy defects in quenched tungsten by combined field-ion microscopy and electrical resistometry, 10:11374 (J;GB)
Park, S.M., Electrochemistry of carbonaceous materials and coal, 10:11279 (J;US)
Parke, S.J., *See* Drell, S.D., 10:11849
Parker, A.J., *See* Rentz, R.L., 10:11248
Parker, E.R., *See* Ritchie, R.O., 10:11335
Parker, G., *See* Arey, D., 10:10931
Parker, J., *See* Greenwald, M., 10:11976
Parker, J.C., *See* Bell, J.C., 10:10875
Parker, R., *See* Greenwald, M., 10:11976
Parks, D.M., *See* Argon, A.S., 10:11332
Parks, P.B., Suppression of flute instability in an axisymmetric double-cusp plasma by RF ponderomotive force, 10:11960 (J;AT)
Parks, R.A., *See* Shapira, D., 10:11868
Parr, P.D., Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 4, Appendix D: endangered and threatened plant species, 10:11194 (R;US)
Parrish, P.R., *See* Duke, T.W., 10:10942
Partridge, A.C., *See* Burdon, R.G., 10:10916
Pasciak, J.E., New scalar potential formulation of the magnetostatic field problem, 10:11924 (J;US)
See Friedman, M.J., 10:11925
Pask, J.A., Stable and metastable phase equilibria and reactions in the SiO_2-αAl_2O_3 system, 10:11400 (J;IT)
See Nagesh, V.K., 10:11381
Patel, B.R., *See* Block, D.L., 10:11050
Patel, J.G., Role of pilot plants in the development of U-Gas commercial reactor design, 10:10829 (R;US)
Patel, P.S., *See* Bharvani, R., 10:11234
Patro, J.B., *See* Balaramamoorthy, K., 10:11110
Paulsen, M.P., *See* Peterson, C.E., 10:11174, 10:11175
Pautz, J., *See* Krabiel, H., 10:11313
Peanasky, M.J., Effect of pressure on the optical absorption edge of sulfur to 300 kbar, 10:11421 (J;US)
Pearson, C.V., *See* Pierson, F.W., 10:11011
Peercy, P.S., Thermodynamic and kinetic studies of pulsed laser annealing from transient conductivity measurements, 10:11349 (R;US)
See Dobisz, E.A., 10:11350
See Thompson, M.O., 10:11412
Peiniger, M., Production and testing of an s-band resonator with a Nb_3Sn surface, 10:11555 (R;DE;In German)
Pelroy, R.A., Microbial mutagenicity of 3- and 4-ring polycyclic aromatic sulfur heterocycles, 10:11702 (J;NL)
Pendleton, B.J., *See* Kennedy, A.D., 10:11858
Pendry, J.B., *See* Saldin, D.K., 10:11909
Peng, Y.K., *See* Reid, R.L., 10:11991
Penny, R.D., *See* Buckingham, M.J., 10:10889
Pennycook, S.J., High resolution Z-contrast imaging and lattice location analysis of dopants in ion-implanted silicon, 10:11407 (R;US)
See Lowndes, D.H., 10:11406
Pepmiller, P.L., *See* Rosseel, T.M., 10:11762
Pepper, D.W., Numerical solution of natural convection in eccentric annuli, 10:11511 (J;US)
Perepezko, J.H., *See* Dobisz, E.A., 10:11350
Perez-Mendez, V., Wire chamber radiation detector with discharge control, 10:11571 (P;US)
Perlmutter, A., Gauge theories, massive neutrinos, and proton decay, 10:11812 (B;US)
Perry, J.H., Aerodynamics of burner jets designed for brown coal fired boilers, 10:10929 (R;AU)
Peruzzi, I., *See* Fernandez, E., 10:11827

Peskin, A.M., Role of optical disk at computing centers, 10:12008 (R;US)
Peterson, C.E., RETRAN-02: a program for Transient Thermal-hydraulic Analysis of Complex Fluid Flow Systems. Volume 3. User's manual. Revision 2, 10:11174 (R;US)
RETRAN-02: a program for Transient Thermal-hydraulic Analysis of Complex Fluid Flow systems. Volume 2. Programmer's manual. Revision 2, 10:11175 (R;US)
Peterson, E.A., *See* Collick, B., 10:11831
Peterson, R.J., *See* Ullmann, J.L., 10:11878
Peterson, R.R., *See* Uesaka, M., 10:11986
Peterson, S.A., *See* Thomas, J.M., 10:11618
Petrich, C.H., Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 7, Appendix G: geography, demography, topography, and soils, 10:11197 (R;US)
Petrykowski, J.C., UO_2 aerosol release from pools of sodium, 10:11156 (R;US)
Petterson, B.J., *See* Bower, W.I., 10:11045
Peuker, J., *See* Engel, H., 10:11104
Pflasterer, G.R., *See* Daniels, E., 10:11178
Philipp, A., *See* Albrecht, H., 10:11816
Phillip, G.M., Computer modelling of coal basins, 10:10891 (R;AU)
Phillips, J.B., *See* Smith, G.V., 10:11443
Phillips, P.J., Numerical model to simulate the processing of electrical distribution cables. Part II. Curing rates, 10:11072 (J;US)
Pi, S., *See* Castorina, P., 10:11856
Piccolo, M., *See* Fernandez, E., 10:11827
Pickrell, M.M., *See* Lipschultz, B., 10:11964
Picraux, S.T., Ion implantation metallurgy, 10:11364 (J;US)
Tailored surface modification by ion implantation and laser treatment, 10:11362 (J;US)
Pierce, R.D., Molten carbonate fuel cells: development status, 10:11229 (RA;US)
See Smith, J.L., 10:11237
Pierce, R.E., BEARING and BPLOT: two programs for designing full (360-degree) journal bearings, 10:11479 (R;US)
Pierce, T.E., Evaluation of alternative gaussian plume dispersion modeling techniques in estimating short-term sulfur dioxide concentrations, 10:11590 (R;US)
Pierce, W.B., Circulating water cooling system for a Camac Crate, 10:11567 (R;US)
Vernier Delay Unit, 10:11553 (R;US)
Pierson, F.W., Energy from municipal waste: assessment of energy conservation and recovery in municipal wastewater treatment, 10:11011 (R;US)
Piet, S.J., The materials impact on fusion reactor safety, 10:11990 (J;US)
Pietrafesa, L.J., Shelfbreak circulation, fronts and physical oceanography: east and west coast perspectives, 10:11730 (J;US)
See Janowitz, G.S., 10:11731
Pigeaud, A., *See* Paetsch, L., 10:11235
Piispanen, W., *See* Strom, L., 10:11131
Pilch, M., *See* Tarbell, W.W., 10:11172
Pin, F.G., Radionuclide migration pathways analysis for the Oak Ridge Central Waste Disposal Facility on the West Chestnut Ridge site, 10:11002 (R;US)
Pinson, J.W., Tritium analysis of the Tatum Salt Dome Area, 10:11635 (R;US)
Pipkins, J.F., *See* Uckan, N.A., 10:11982
Pitelka, F.A., *See* Myers, J.P., 10:11640
Pittman, P.F., 50 kW on-site concentrating solar photovoltaic power system. Phase I: design. Final report, 1 June 1978-28 February 1979, 10:11043 (R;US)
Plastino, A., *See* Bozzolo, G., 10:11894
Pleasance, L.D., *See* Matthews, D.L., 10:11499
Pluth, J.J., Crystal structure of low cristobalite at 10, 293, and 473 K: Variation of framework geometry with temperature, 10:11353 (J;US)
Poa, D.S., Mechanism and kinetics of iron electrode dissolution in KOH electrolytes, 10:11179 (R;US)
Poenitz, W.P., Final results of the internal ^{235}U sample intercomparison and the half-life of ^{234}U, 10:11882 (R;US)
Simultaneous evaluation of interrelated cross sections by generalized least-squares and related data file requirements, 10:11862 (R;US)
Poeppel, R.B., *See* Fee, D.C., 10:11226, 10:11245
Pollak, E., Harmonic tunneling corrections to sudden and adiabatic transition state theory, 10:11776 (J;US)
Pollard, J.E., Torsional potential and intramolecular dynamics in the $C_2H^+_4$ photoelectron spectra, 10:11788 (J;US)
Pollard, W.B., *See* Lucovsky, G., 10:11036
Pollis, R., Role of the governmental authority in LWR fuel fabrication QA activities in Brazil, 10:11080 (RA;DE)
Pope, L.E., *See* Picraux, S.T., 10:11362
Popp, R.A., Analysis of a mouse α-globin gene mutation induced by ethylnitrosourea, 10:11691 (J;US)
Porat, D., *See* Briggs, D., 10:11569
Porter, D.L., *See* Liu, Y.Y., 10:11390
Post, R.S., *See* Sevillano, E., 10:11930
Potter, G.L., Background Tropospheric Aerosols: Incorporation within a statistical-dynamical climate model, 10:11601 (J;US)
Powell, J.R., Prospects for low activity aluminium structures, 10:12000 (BA;GB)
Powers, K.D., How seabirds adapt to ocean processes, 10:11628 (J;US)
Pratt, S.T., Photoelectron angular distributions from resonant multiphoton ionization of atomic carbon, 10:11771 (J;US)
Preston, E.L., Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 13, Appendix M: Oak Ridge National Environmental Research Park, 10:11203 (R;US)
Preston, R.J., *See* Heartlein, M.W., 10:11709
Pretzl, K.P., *See* Fessler, H., 10:11564
Priedhorsky, W.C., *See* Terrell, J., 10:11745
Primm, R.T. III, *See* Easter, M.E., 10:10963
Primont, D., *See* Arey, D., 10:10931
Prosnitz, D., *See* Fawley, W.M., 10:11500
Providakes, G., *See* Anselmo, A., 10:11535
Pudick, S., *See* Buchanan, W., 10:11231
Puett, J., *See* Chance, W.W., 10:11207
Pulley, H.R., Use of volunteer organizations in emergency operations, 10:11720 (RA;US)
Pyle, R.V., *See* Burrell, C.F., 10:11935

Q

Qi, N., *See* Fernandez, E., 10:11827
Quigg, C., Standard model and beyond, 10:11853 (R;US)

R

Raaen, S., Observation of a first-order phase transition in Xe/Ta(110) by photoelectron spectroscopy, 10:11360 (J;US)
Raghavan, S.V., *See* Balaramamoorthy, K., 10:11110
Ragheb, M., *See* Miley, G., 10:11997
Rahn, R.O., *See* Shugart, L., 10:11706
Raich, U., Fast data acquisition system for spectroscopy experiments, 10:11562 (R;DE;In German)
Rainer, F., Bulk and surface damage thresholds of crystals and glasses at 248 nm, 10:11424 (J;US)
Rajan, S., *See* Davis, P.K., 10:10923
See Hesketh, H.E., 10:10922
Rajendran, R., *See* Balaramamoorthy, K., 10:11110
Raleigh, C.B., Catfish Club, 10:11719 (RA;US)
Raman, S., *See* Rosseel, T.M., 10:11762
See Vane, C.R., 10:11763
Rambach, G., *See* Matthews, D.L., 10:11499
Ramond, P.M., *See* Field, R.D., 10:11838
Randa, J., Diffraction: what do we know; what can we learn, 10:11834 (R;US)
Randall, S.A., *See* Breault, R.D., 10:11275, 10:11277
Ransom, V.H., *See* Carlson, K.E., 10:11154
See Wagner, R.J., 10:11144
Rao, A.S., *See* Mehrotra, B.N., 10:11425
Rao, K.S., *See* Ward, R.C., 10:11608
Rasolt, M., Structure factors for a binary mixture of quantum and classical fermion liquids, 10:11804 (J;US)
Rassell, K.T., *See* Omelchenko, A.N., 10:11748
Rauch, H.W., *See* O'Steen, W.N., 10:10882
Rauscher, R., Computerized ultrasonic tube testing systems with special reference to the installation in tube mills for nuclear tubing of fuel fabrication facilities, 10:11106 (RA;DE)
Raymond, J.R., *See* Allen, R.D., 10:11632
Raymond, R.S., *See* Ullmann, J.L., 10:11878
Raynor, G.S., Effects of varying air trajectories on spatial and temporal

precipitation chemistry patterns, 10:11606 (J;NL)
Read A.L. Jr., *See* Fernandez, E., 10:11827
Reavis, J.G., Plutonium metal and alloy preparation by molten chloride reduction, 10:11342 (R;US)
Rebizant, J., *See* Lander, G.H., 10:11361
Ree, F.H., *See* Kang, H.S., 10:11922
Ree, T., *See* Kang, H.S., 10:11922
Reece, W.D., Adequacy of current systems for monitoring extremity exposures at nuclear power plants, 10:11905 (R;US)
Reed, D.J., *See* Livesey, J.C., 10:11676
Reed, P.E., *See* Azevedo, L.J., 10:11411
Reed, T.E., Biomass gasification: principles and technology, 10:11019 (B;US)
Reeves, J.H., *See* Brodzinski, R.L., 10:11566
Regan, J.D., Excision repair of ultraviolet- and chemically-induced damage in the DNA of fibroblasts derived from two closely related species of marine fishes, 10:11701 (J;NL)
Reich, C.W., Report on the participation of US laboratories in the work of the IAEA coordinated research program on the measurement and evaluation of transactinium isotope nuclear decay data, 10:11883 (R;US)
Reid, R.L., System studies for a quasi-steady-state Advanced Physics Tokamak/, 10:11991 (J;US)
Reimann, R.C., Development of a single-family absorption chiller for use in a solar heating and cooling system. Phase III, final report. Volume I, 10:11051 (R;US)
Development of a single-family absorption chiller for use in a solar heating and cooling system. Phase III, final report. Volume II, 10:11052 (R;US)
Reines, F., *See* Park, H.S., 10:11828
Reiser, C.A., *See* Meyer, A.P., 10:11236
Rentz, R.L., Computer model of UTC 11-MW fuel cell power plant, 10:11248 (RA;US)
Reucroft, P.J., *See* Dhere, A.G., 10:11439
Reutt, J.E., *See* Pollard, J.E., 10:11788
Revis, N.W., Response of the adrenergic system in the cadmium-induced hypertensive rat, 10:11707 (J;US)
Reynolds, P.S., *See* Wolcott, D.R., 10:11220, 10:11221
Rhee, H., *See* Koseff, J.R., 10:11508
Rice, J.E., Transport of injected impurities in Heliotron E, 10:11959 (J;AT)
Rice, J.L., *See* Munir, Z.A., 10:11457
Richards, P.G., *See* Menke, W., 10:11722
Richardson, I.G., *See* Tsurutani, B.T., 10:11758
Riches, C.G., Cutaneous melanoma in two populations occupationally exposed to internal deposition of plutonium, 10:11673 (R;US)
Richmond, J.C., *See* Dils, R.R., 10:11391
Rickard, W.H., Birds of the Hanford site: nest site selection, 10:11626 (R;US)
Standing crop and production in annual grass communities in Washington and California: a comparison, 10:11027 (R;US)
Standing crop and production in an undisturbed shrubsteppe community in eastern Washington, 10:11028 (R;US)
Riester, L., *See* Swenson, P.A., 10:11684
Rigby, G.R., Quantitative characterisation of mineral matter in a range of coals and coal generated materials, 10:10857 (R;AU)
Rikvold, P.A., Porosity and specific surface for interpenetrable-sphere models of two-phase random media, 10:11921 (J;US)
Riley, M.E., Energy transfer in the collision of an atom with a cold lattice, 10:11784 (J;US)
Rinsland, C.P., Stratospheric NO and NO2 profiles at sunset from analysis of high-resolution balloon-borne infrared solar absorption spectra obtained at 33 deg N and calculations with a time-dependent photochemical model, 10:11589 (R;US)
Ristinen, R.A., *See* Ullmann, J.L., 10:11878
Ritchie, B., Photoelectron motion in the presence of a probe electromagnetic wave, 10:11794 (J;US)
Ritchie, R.H., *See* Garcia-Molina, R., 10:11774
Ritchie, R.O., New series of advanced 3Cr-Mo-Ni steels for thick section pressure vessels in high temperature and pressure hydrogen service. Topical report, February 1, 1982-January 31, 1984, 10:11335 (R;US)
Rittenberg, V., *See* Hoeger, C., 10:11917
Rivet, M.F., *See* Jacquet, D., 10:11886
Ro, S.T., *See* Kestin, J., 10:11465
Roberts, O.C., *See* Cudmore, J.F., 10:10846
Robin, A.M., *See* Child, C.A., 10:10830
Robin, J.P., *See* Nury, J.C., 10:11126
Robinson, P., Ultrasonic vs mechanical comminution of coal II, 10:10906 (RA;US)
Rocket, P.D., *See* Rosen, M.D., 10:11498
Roderburg, E., *See* Comminchau, V., 10:11559
Roderer, N.K., Value of the National Energy Software Center and the Radiation Shielding Information Center. Volume 2, 10:12028 (RA;US)
See King, D.W., 10:12026
Rodman, M., Simulation calculations for a catalytic exchange/cryogenic distillation hydrogen isotope separation process, 10:11137 (R;US)
Rodrigue, G., Preconditioning by incomplete block cyclic reduction, 10:12021 (J;US)
Rodriguez, D.J., Evaluation of a series of SF_6 tracer releases using the MATHEW/ADPIC model, 10:11599 (R;US)
Roeckl, E., *See* Kirchner, R., 10:11547
Roepenack, H., *See* Gruber, K., 10:11083
Roeser, A., Value of α-fetoprotein determination in infants and a method of determination by RIA, 10:11650 (R;DE;In German)
Rogers, F.J., *See* Ross, M., 10:11414
Rogers, H., *See* Gill, W.W., 10:10856
Rogers, L.E., Sampling honeybee colonies for brood production: a double sampling technique, 10:11670 (J;US)
Rokop, D.J., *See* Wolfsberg, K., 10:11740
Rose, R.R., *See* Dickens, P.S., 10:10883
Rose, S.D., Two-dimensional modeling of sodium boiling in a simulated LMFBR loss-of-flow test, 10:11155 (R;US)
Rosen, L.C., *See* Rodriguez, D.J., 10:11599
Rosen, M.D., Exploding foil technique for achieving a soft x-ray laser, 10:11498 (J;US)
See Matthews, D.L., 10:11499
Rosen, S.P., Derivation of the Wolfenstein form of the Kobayashi-Maskawa matrix from fermion masses, 10:11846 (J;US)
Rosenbalm, E.H., *See* Bradburn, D.M., 10:11196
Rosenblum, M., Linear tearing mode stability for low-q cylindrical tokamaks, 10:11970 (J;GB)
Rosenwinkel, E., *See* Miller, T., 10:11375
Ross, D.J., *See* Mallett, C.W., 10:10900
Ross, M., Structure of dense shock-melted alkali halides: Evidence for a continuous pressure-induced structural transition in the melt, 10:11414 (J;US)
Ross, P.N. Jr., Advanced electrolytes for acid fuel cells: an overview, 10:11264 (RA;US)
Rosseel, T.M., Effect of the chemical environment on the L and M heavy-ion-induced x-ray satellite emission spectra, 10:11762 (R;US)
Rossi, G., *See* Comin, F., 10:11417
Rosskamp, P., *See* Althoff, M., 10:11818
Rosynek, M.P., Properties of lanthanide oxides as supports for transition metal catalysts. Progress report, May 1, 1984-April 30, 1985, 10:11441 (R;US)
Rothert, J.E., MAP3S precipitation chemistry network: seventh periodic summary report, 1983, 10:11594 (R;US)
Rothman, S.J., *See* Mantl, S., 10:11382
Rothschild, E.R., Characterization of soils at proposed Solid Waste Storage Area (SWSA) 7, 10:11625 (R;US)
Geohydrologic characterization of proposed Solid Waste Storage Area (SWSA) 7, 10:10978 (R;US)
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 10, Appendix J: hydrology, 10:11200 (R;US)
Rottmann, J., *See* Kirchhoefer, H., 10:11340
Rotundo, L., *See* Block, D.L., 10:11050
Rowen, B., Energy and nuclear futures to 2025: an overview, 10:11208 (R;US)
Rowen, H.S., *See* Rowen, B., 10:11208
Rowley, D., *See* Griffioen, K.A., 10:11885
Rowley, J.K., Chlorine solar neutrino experiment, 10:11735 (R;US)
Roxborough, F.F., Longwall coal mining operations computer simulation, 10:10895 (R;AU)
Roy, W.K., *See* Franco, P.J., 10:10886
Ruckman, M., *See* Raaen, S., 10:11360
Rudaz, S.L., NMR study of the chemisorption bond of carbon monoxide on platinum, 10:11418 (J;US)
Rudder, R.A., *See* Lucovsky, G., 10:11036
Ruddick, K., *See* Collick, B., 10:11831
Rudigier, H., *See* Ott, H.R., 10:11355
Rudsinski, L.E., Impact of scalar performance on vector and parallel processors, 10:12014 (R;US)
Ruger, C.J., *See* Diamond, D.J., 10:11138
Ruggiero, A., *See* Simpson, J., 10:11536

Rundle, J.B., Model for deformation in Long Valley, California, 1980-1983, 10:11727 (J;US)
Rustagi, R.S., Quality control and performance of PHWR fuel in India, 10:11111 (RA;DE)
Rybalchenko, I.L., Technology and performance of water reactor fuel, 10:11079 (RA;DE)
Rybicki, E.F., Proppant transport model. Final report, 10:10950 (R;US)
Rykaczewski, K., *See* Kirchner, R., 10:11547

S

Sabetimani, Z., *See* Burrell, C.F., 10:11935
Sadrozinski, H., *See* Briggs, D., 10:11569
Sadrozinski, H.F.W., *See* Burchat, P.R., 10:11568
Sager, P.H., FED reactor engineering features, 10:12001 (BA;GB)
Saha, A., *See* Glass, G., 10:11829
Saito, R., *See* Sakai, T., 10:11268
Sakai, T., Development of 50 kW fuel cell power plant, 10:11268 (RA;US)
Sakamoto, K., *See* Akimaru, S., 10:11267
Saldin, D.K., Interpretation of diffuse low-energy electron diffraction intensities, 10:11909 (J;US)
Sales, B.C., Lead-iron phosphate glass: a stable storage medium for high-level nuclear waste, 10:10995 (J;US)
Sam, R.G., *See* Block, D.L., 10:11050
Sammons, V.O., Quarks, 10:11810 (R;US)
Samuelson, R.D., Rate-of-return regulation and efficiency: the economics of the natural gas pipeline and distribution industry, 10:10953 (R;US)
Sander, H.G., *See* Althoff, M., 10:11818
Sanders, B.M., *See* Jenkins, K.D., 10:11703
Sanders, M., Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 3, Appendix B: archaeological considerations, 10:11193 (R;US)
Santella, R.M., *See* Jones, C.A., 10:11710
Santen, A. van, QA/QC for nuclear fuel fabrication at ASEA-Atom, Sweden, 10:11082 (RA;DE)
Sato, H., *See* Nagata, S., 10:11270
Sato, Hiroshi, Tracer diffusion in an ordered alloy: application of the path probability and Monte Carlo methods, 10:11333 (R;US)
Satyanarayana, P., Influence of magnetic shear on the collisional current driven ion cyclotron instability. Memorandum report October 1983-October 1984, 10:11747 (R;US)
Sauer, R.H., *See* Rickard, W.H., 10:11028
Saunders, M.A., *See* Gill, P.E., 10:12016
Savitz, D.A., Cancer risk among oil-refinery workers: a review of epidemiologic studies, 10:10939 (J;US)
Scaife, P.H., In seam exploration in coal mines using vibration measurement, 10:10890 (R;AU)
See Gill, W.W., 10:10856
Scamehorn, J.F., Study of Micellar-Enhanced Ultrafiltration. Progress report, March 1, 1984-February 28, 1985, 10:11427 (R;US)
Scarf, F.L., Plasma wave spectra near slow mode shocks in the distant magnetotail, 10:11753 (J;US)
Schaap, H.A., *See* Bone, K.M., 10:10878
Schaich, R.W., Oak Ridge National Laboratory shipping containers for radioactive materials, 10:11486 (R;US)
Schaller, S., *See* Carruthers, J., 10:10896
Schardt, D., *See* Kirchner, R., 10:11547
Scharlemann, E.T., *See* Fawley, W.M., 10:11500
Scharnhorst, N.L., Remote removal of contaminated equipment from a radiochemical engineering cell, 10:10985 (R;US)
Schatz, G.C., *See* Eaker, C.W., 10:11786
Schery, S.D., *See* Wilkening, M., 10:11609
Schiefelbein, G.F., Overview of DOE's biomass thermochemical conversion process, 10:11018 (R;US)
Schierholz, G., Comparison of quark and gluon jets, 10:11837 (R;DE)
Schillaci, M.E., *See* Boekema, C., 10:11394
Schimmler, J., Aortography following subdiaphragmal aortic biopsy. Evaluation of 94 aortographies for an analysis of biopsy techniques and filling conditions including the peripheral regions, 10:11651 (R;DE;In German)
Schira, P., Investigation of a natural convection in a small slot using a finite difference method, 10:11509 (R;DE;In German)
Schirber, J.E., Light-hole conduction in InGaAs/GaAs strained-layer superlattices, 10:11415 (J;US)
See Azevedo, L.J., 10:11411
See Kwak, J.F., 10:11915
Schlachter, A.S., *See* Burrell, C.F., 10:11935
See Tanis, J.A., 10:11781
Schlenker, R.A., Distribution of radium and plutonium in human bone, 10:11672 (R;US)
Schlitt, L.G., Pulsed power for race track induction accelerators, 10:11528 (R;US)
Schmidt-Boecking, H., *See* Meron, M., 10:11759
Schmidt-Parzefall, W., *See* Albrecht, H., 10:11816
Schmitt, R.J., *See* Uckan, N.A., 10:11982
Schmitz, D., *See* Althoff, M., 10:11818
Schmitz-Feuerhake, I., *See* Meyer, H.J., 10:11657
Schmoyer, R., *See* Lock, S., 10:11687
Schneider, T., *See* Abens, S., 10:11257
Schneider, W., *See* Herschbach, K., 10:11385
Schneiderman, S., Reduction of coal in solvated electron solutions, 10:10852 (RA;US)
Scholer, M., Magnetospheric ions and electrons in the distant magnetoshearth at ~50 R/sub E/ and ~180 R/sub E/: ISEE-3 observations, 10:11757 (J;US)
Simultaneous observation of the plasma sheet in the near earth and distant magnetotail: ISEE-1 and ISEE-3, 10:11751 (J;US)
Schramm, D.N., Phase transitions and dark matter problems, 10:11737 (R;US)
Schreckhise, R.G., *See* Cline, J.F., 10:11621
Schrempp, B., Massive Yang-Mills - an effective Lagrangian for composite Wsup(+-), Z and new coloured vector bosons, 10:11836 (R;DE)
Schrempp, F., *See* Schrempp, B., 10:11836
Schroder, I.G., *See* Gilliam, D.M., 10:11941
Schroeder, H., *See* Albrecht, H., 10:11816
Schroeder, L.S., Experiments with heavy beams at the Berkeley Bevalac, 10:11533 (R;US)
Report on the 1984 LBL workshop on detectors for relativistic nuclear collisions, 10:11550 (R;US)
Schroeder, P., *See* Meyer, H.J., 10:11657
Schroeder, V., *See* Behrend, H.J., 10:11815
Schroll, C.R., *See* Meyer, A.P., 10:11236
Schubert, F., *See* Kirchhoefer, H., 10:11340
Schubert, W.K., High sheet resistance, arsenic implanted polycrystalline silicon for integrated circuit resistors, 10:11519 (R;US)
Schuch, R., *See* Meron, M., 10:11759
Schuller, I.K., *See* Yudkowsky, M., 10:11356
Schulson, E.M., Flow localization accompanying the intergranular fracture of Ni_3Al, 10:11369 (J;US)
Schultz, J., *See* Park, H.S., 10:11828
Schultz, K.R., *See* Conn, R.W., 10:11993
Schultz, P.J., Large-angle positronium emission for Al(110), 10:11760 (R;US)
Schulz, F., *See* Wittmaack, K., 10:11531
Schulz, H.D., *See* Albrecht, H., 10:11816
Schulz, M.A., *See* Baca, A.G., 10:11451
Schulz, W.W., Bifunctional organophosphorus liquid-liquid extraction reagents: development and applications, 10:11464 (R;US)
Schumacher, G., *See* Breitung, W., 10:11164
Schuresko, D.D., *See* Foster, C.A., 10:12002
Schwalbe, L.A., Review of deuterium triple-point temperatures, 10:11453 (J;US)
Schwartz, S.J., *See* Feldman, W.C., 10:11755
Schwenke, D.W., *See* Brown, F.B., 10:11447
Scofield, J.H., *See* Matthews, D.L., 10:11499
Scott, J.L., Special purpose materials for fusion application, 10:11974 (R;US)
Scott, J.S., Studies of X-ray clusters of galaxies/intergalactic plasmas. Final Report, 10:11742 (R;US)
Scott, T.G., *See* Garten, C.T. Jr., 10:11619
Seagrave, J.C., Zinc effects on glutathione metabolism relationship to zinc-induced protection from alkylating agents, 10:11700 (J;GB)
Sealock, L.J. Jr., Development of an advanced water-gas shift conversion system. Monthly project status report No. 8, December 1-December 31, 1984, 10:10843 (R;US)
Searls, J., *See* Buckingham, M.J., 10:10889
Sears, R.G., *See* Schlitt, L.G., 10:11528
Seedsman, R.W., *See* Mallett, C.W., 10:10900
Seeley, F.G., Geochemical information for sites contaminated with low-level radioactive wastes: II. St. Louis Airport Storage Site, 10:11003 (R;US)
Seidel, S., *See* Park, H.S., 10:11828
Seiden, A., *See* Briggs, D., 10:11569

Seitz, W.L., Short-duration shock initiation of triaminotrinitrobenzene (TATB), 10:11583 (BA;NL)
Sekula, S.T., Magnetic studies of $Ni_3Al(Fe)$ compounds, 10:11330 (R;US)
Selkirk, J.K., *See* Jones, C.A., 10:11710
Selkowitz, S., *See* Navvab, M., 10:11291
See Ne'eman, E., 10:11316
Sellmann, L., *See* Meyer, H.J., 10:11657
Selonke, F., *See* Albrecht, H., 10:11816
Sen, A., Comparison of the canonical Hamiltonian and the Hamiltonian of Callan and Rubakov for the monopole-fermion system, 10:11845 (J;US)
Seth, K.K., *See* Glass, G., 10:11829
Setser, D.W., *See* Inoue, G., 10:11792
Sevillano, E., TARA diagnostic set, 10:11930 (R;US)
Seyboth, P., *See* Fessler, H., 10:11564
Seyerlein, J., *See* Fessler, H., 10:11564
Seyler, C.E., Stability of an elongated axisymmetric mirror with an energetic axis-encircling ion component, 10:11968 (J;AT)
Shabtai, J.S., *See* Massoth, F.E., 10:11458, 10:11459, 10:11460
Shaikh, A.M., Overview of the energy situation in ECOWAS countries, 10:11283 (RA;US)
Shapira, D., Nuclear physics experiments with the ORNL-HHIRF supersonic gas jet target, 10:11868 (R;US)
Shapiro, S., *See* Williams, S., 10:11570
Sharan, H.N., Energy efficiency in electrical power generation and industrial sectors, 10:11307 (RA;US)
Sharp, D.H., *See* Bender, C.M., 10:11855
Shelbley, D.W., NASA fuel cell applications for space, 10:11256 (RA;US)
Sheih, C.M., Field validation of six-particle puff model, 10:11588 (R;US)
Shepard, C.L., *See* Rosen, M.D., 10:11498
Sherman, R.L., *See* McKown, H.S., 10:11579
Sherwood, A.E., Tritium permeation and recovery for the helium-cooled molten salt fusion breeder, 10:11983 (R;US)
Shestakov, A.I., Fourier method for three-dimensional partial differential equations in periodic geometry. Application: HELIAC, 10:11985 (J;US)
Shiba, M., Open-ended rat tracheal implant model: toxic effects of formaldehyde on the respiratory epithelium, 10:11699 (J;NL)
Shibaoka, M., Coal characteristics and their role in hydrogenation, 10:10858 (R;AU)
See Bennett, A.J.R., 10:10917
Shimeck, D.J., Evaluation of on-line control techniques for heater rods in the Semiscale Mod-3 system, 10:11140 (R;US)
Shimomura, S., Alcohol dehydrogenase and an inactivator from rice seedlings, 10:11644 (J;US)
Alcohol dehydrogenase inactivator from rice seedlings: properties and intracellular location, 10:11645 (J;US)
Shimomura, T., *See* Williams, S., 10:11570
Shines, J.E., Multispectral Remote Sensing at the Savannah River Plant, 10:11623 (R;US)
Shirane, G., Paramagnetic scattering from a cubic ferromagnet Pd_2MnSn, 10:11354 (J;US)
Shirley, D.A., *See* Baca, A.G., 10:11451
See Lindle, D.W., 10:11789
See Pollard, J.E., 10:11788
Shivakumar, B., *See* Shapira, D., 10:11868
Shively, J., *See* Jory, H., 10:11973
Shoemaker, C., *See* Robinson, P., 10:10906
Shore, B.W., *See* Eberly, J.H., 10:11795
See Wodkiewicz, K., 10:11798
Shoun, P.H., Preventive maintenance in the electric power sector, 10:11306 (RA;US)
Shugart, L., Dosimetry of PAH skin carcinogenesis: covalent binding of benzo[a]pyrene to mouse epidermal DNA, 10:11706 (J;US)
Shumard, E., *See* Park, H.S., 10:11828
Shunk, W.A., Schedule planning for construction projects, 10:12004 (R;US)
Siciliano, E.R., *See* Ullmann, J.L., 10:11878
Siebke, H., *See* Althoff, M., 10:11818
Siegel, R.B., *See* King, D.L., 10:11033
Siegel, R.W., *See* Park, J.Y., 10:11374
Siegman, A.E., Laser physics and laser techniques. Final technical report 1 February 1982-31 January 1984, 10:11496 (R;US)
Sieradzki, K., *See* Newman, R.C., 10:11377
Sikka, V.K., *See* Foulds, J.R., 10:11370
Silverman, B., *See* Bloomfield, P., 10:10934
Simmons, J.E., *See* Glass, G., 10:11829
Simmons, R.O., *See* Sokol, P.E., 10:11419
Simpson, D.T., Particle detector performance in a Fermilab experiment, 10:11548 (R;US)
Simpson, J., Summary report: injection group, 10:11536 (R;US)
Simpson, J.C., *See* Thomas, J.M., 10:11618
Sinclair, D., *See* Park, H.S., 10:11828
Sincovec, R.F., User's and programmer's guide to the mechanics of Moving Finite Element code, 10:12018 (R;US)
Sindt, H., *See* Behrend, H.J., 10:11815
Sinfelt, J.H., *See* Rudaz, S.L., 10:11418
Singh, H.J., *See* Kern, R.D., 10:11475
Sinha, A.K., Size classification of Illinois basin coals for desulfurization by froth flotation, 10:10908 (RA;US)
Siomos, K., *See* Faidas, H., 10:11467
Siscoe, G.L., *See* Crooker, N.U., 10:11750
Sjoreen, T.P., New focal plane detector system for the broad range spectrometer, 10:11541 (R;US)
Skalski, J.R., *See* Thomas, J.M., 10:11618
Skiff, F., Parasitic excitation of ion Bernstein waves from a Faraday shielded fast wave loop antenna, 10:11945 (R;US)
Skiles, D.D., Public participation in studies of animal behavior prior to earthquakes: some cautionary remarks, 10:11716 (RA;US)
Skow, L.C., *See* Popp, R.A., 10:11691
Slagle, O.D., Fuel transient deformation, 10:11128 (J;NL)
Slate, S.C., *See* Farnsworth, R.K., 10:10984
Slattery, P., *See* Collick, B., 10:11831
Slavin, J.A., *See* Gosling, J.T., 10:11756
See Hones E.W. Jr., 10:11752
See Scarf, F.L., 10:11753
See Smith, E.J., 10:11754
Slegel, D.L., *See* Carlson, K.E., 10:11154
Slichter, a.C.P., *See* Rudaz, S.L., 10:11418
Small, G.J., *See* Heisig, V., 10:11642
Smalley, R.E., *See* Geusic, M.E., 10:11449
Smith, D.H., *See* McKown, H.S., 10:11579
Smith, D.K., *See* Sevillano, E., 10:11930
Smith, D.L., *See* Conn, R.W., 10:11993
See Green, W.V., 10:11422
See Liu, Y.Y., 10:11390
Smith, E.D., *See* Rothschild, E.R., 10:11200
Smith, E.F. III, *See* Brock, A.J., 10:11055
Smith, E.J., Slow mode shocks in the earth's magnetotail: ISEE-3, 10:11754 (J;US)
See Gosling, J.T., 10:11756
See Hones E.W. Jr., 10:11752
See Scarf, F.L., 10:11753
See Tsurutani, B.T., 10:11758
Smith, G.E., *See* Sager, P.H., 10:12001
Smith, G.V., Performance characteristics of axisymmetric venturi-like reverse-flow diverters. Consolidated Fuel Reprocessing Program, 10:10964 (R;US)
Structure-sensitive catalytic dehydrogenation of hydrogen donor over iron sulfides: new methods for increasing coal depolymerization under mild conditions, 10:11443 (RA;US)
Smith, H.D., Zircaloy cladding corrosion degradation in a Tuff repository: initial experimental plan, 10:10973 (R;US)
Smith, H.I., Zone-melting recrystallization for solar cells. Final report, September 1, 1982-August 31, 1984, 10:11025 (R;US)
Smith, I.D., *See* Schlitt, L.G., 10:11528
Smith, J.G., *See* Fernandez, E., 10:11827
Smith, J.L., Stable materials for molten carbonate fuel cell cathodes, 10:11237 (RA;US)
Smith, J.V., *See* Pluth, J.J., 10:11353
Smith, M.C., *See* Baksay, L.A., 10:11578
Smith, M.S., *See* Vane, C.R., 10:11763
Smith, P.D., *See* Baker, J.W., 10:10845
Smock, R., Decontamination pays off for nuke owners, 10:11089 (J;US)
Snelgrove, J.L., *See* Deen, J.R., 10:11133
Snipes, J.A., Initial bolometric measurements on text, 10:11931 (R;US)
Snyder, R.D., *See* Regan, J.D., 10:11701
Sobel, H.W., *See* Park, H.S., 10:11828
Sobel, M., Four-urn catenary model for excretion, 10:11667 (J;US)
Sokol, P.E., Structure and thermal expansion in solid deuterium, 10:11419 (J;US)
Solomey, N., *See* Dawson, J.W., 10:11558
Solomon, O.M. Jr., *See* Cadzow, J.A., 10:11928
Somayajulu, G.V.S.R.K., *See* Balaramamoorthy, K., 10:11110
Somorjai, G.A., *See* Saldin, D.K., 10:11909
Sonder, E., Behavior of electrical conduction of spinel and other insulating oxides in moderate electric fields at high temperature, 10:11396 (J;US)
Sondheim, W.E., *See* DiGiacomo, N.J., 10:11870
Sorensen, C.M., *See* Chowdhury, D.P., 10:11807

Sorg, M., Bound and radiation fields of a pointlike SO(3) monopole, 10:11859 (J;US)
South, D.W., Residential energy consumption characteristics of minority population groups: trends in demand and patterns of use, 10:11219 (R;US)
Southworth, G.R., *See* Franco, P.J., 10:10886
See Giddings, J.M., 10:10887
Spalding, B.P., *See* Rothschild, E.R., 10:10978, 10:11625
Spang, S., *See* Jory, H., 10:11973
Spangenberger, H., Quantum interference and statistical fluctuations in deep inelastic heavy-ion reactions, 10:11891 (R;DE)
See Feldmeier, H., 10:11892
Sparks, L., *See* Seyler, C.E., 10:11968
Spess, I.G., Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 9, Appendix I: health, safety, and environmental affairs, 10:11199 (R;US)
Spencer, P.N., *See* Ritchie, R.O., 10:11335
Spieler, H., Fast timing methods for semiconductor detectors. Revision, 10:11563 (R;US)
Spinka, H., Nucleon-nucleon interaction at medium energies, 10:11865 (R;US)
Spirlet, J.C., *See* Lander, G.H., 10:11361
Spong, D.A., Ballooning modes in the ELMO Bumpy Square configuration using the generalized kinetic energy principle, 10:11940 (RA;US)
Radial structure of curvature-driven instabilities in a hot-electron plasma, 10:11963 (J;US)
Stability of the ELMO Bumpy Square, 10:11938 (RA;US)
See Uckan, N.A., 10:11982
Spooner, S., Small-angle x-ray scattering (SAXS) study of coarsening kinetics in an aluminum-lithium alloy, 10:11331 (R;US)
Springer, D.L., *See* Loscutoff, S.M., 10:10933
Springer, R.W., Use of markers to elucidate reacting sputtering processes, 10:11768 (R;US)
Spyrou, S.M., Effect of temperature on nondissociative electron attachment to perfluorobenzene, 10:11773 (J;US)
Srinivasan, S., Electrochemical and surface science research on fuel cells, 10:11262 (RA;US)
See Gonzalez, E.R., 10:11280
Srivastava, V.J., *See* Chynoweth, D.P., 10:11012
Stacey, W.M., Future technology requirements for magnetic fusion--An evaluation based on conceptual design studies, 10:11989 (J;US)
Stacy, W.D., *See* Block, D.L., 10:11050
Stacy, W.O., *See* Brockway, D.J., 10:10859
Stansfield, R.G., *See* Rothschild, E.R., 10:11625
Staudhammer, K.P., 1.2 Mbar shock loaded 304 stainless steel: residual structure and properties, 10:11365 (BA;US)
Stawsky, A., *See* Brand, M.J., 10:11258
Stearns, J.W., *See* Tanis, J.A., 10:11781
Stearns, S.D., *See* Cadzow, J.A., 10:11928
Steckler, R., *See* Brown, F.B., 10:11447
Steele, B.R., *See* Hruby, J.M., 10:11059
Steelman, B.L., Organics contamination of groundwater: an open literature review, 10:11633 (R;US)
Stefan, V., *See* McBride, J.B., 10:11948
Stehn, J.R., *See* Divadeenam, M., 10:11881
Steinberg, E., *See* Assmann, H., 10:11081
Steiner, D., *See* Stacey, W.M., 10:11989
Stell, G., *See* Rikvold, P.A., 10:11921
See Torquato, S., 10:11920
Stella, P.M., Radiation Damage Workshop, 10:11026 (R;US)
Stelson, P.H., *See* Shapira, D., 10:11868
See Ziegler, N.F., 10:11530
Stensvad, S.M., Synthesis and characterization of tetranuclear molybdenum iodide clusters, 10:11444 (R;US)
Stephens, J.F., *See* Shibaoka, M., 10:10858
Stern, P.C., Energy use: the human dimension, 10:11183 (B;US)
Steunenberg, R.K., *See* Fee, D.C., 10:11226, 10:11245
Stevens, D.J., *See* Schiefelbein, G.F., 10:11018
Stevens, D.L., *See* Wehner, A.P., 10:11688
Stevens, J.W., Utility interface: can state-of-the-art power conditioners alleviate our concerns?, 10:11048 (RA;US)
Stevens, W.J., *See* Krauss, M., 10:11438
Stewart, A.J., *See* Franco, P.J., 10:10886
See Giddings, J.M., 10:10887
Stewart, D.L., *See* Pelroy, R.A., 10:11702
Stewart, H.B., Two-phase flow: Models and methods, 10:11510 (J;US)
Stickney, R.G., *See* Waldman, H., 10:10967
Stiegler, J.O., *See* Liu, C.T., 10:11363
Stieglitz, L., Identification of lignosulfonic acid and humic acid by pyrolysis, gas chromatography and mass spectrometry (Py-GC-MS), 10:11437 (TG;US)
Stine, R.A., *See* Bloomfield, P., 10:10934
Stockli, M.P., *See* Tanis, J.A., 10:11781
Stocks, G.M., First principles theory of Fermi-surface driven concentration waves in Cu/sub c/Pd/sub 1-c/ alloys, 10:11328 (R;US)
Stockton, N.D., Coal washery reject disposal, 10:10915 (R;AU)
Stone, G., *See* Matthews, D.L., 10:11499
Stone, J.L., *See* Park, H.S., 10:11828
Stone, R.G., *See* Lengyel-Frey, D., 10:11743
Stonehart, P., Carbon corrosion in hot phosphoric acid fuel cells, 10:11263 (RA;US)
Electrocatalyst advances for hydrogen oxidation in phosphoric acid fuel cells, 10:11281 (J;GB)
Story, J.D., *See* Kitchings, J.T., 10:11206
Stout, M.G., Evaluation of anisotropic effective stress-strain criteria for the biaxial yield and flow of 2024 aluminum tubes, 10:11367 (J;US)
Strasser, A.A., Economic consequences of QA and QC in fuel and fuel assembly production, 10:11078 (RA;DE)
Stratton, W.R., *See* Campbell, D.O., 10:11143
Street, R.A., *See* Biegelsen, D.K., 10:11037
Street, R.L., *See* Koseff, J.R., 10:11506, 10:11508
Streit, R.D., Evaluation of fracture toughness (J/sub IC/) using single specimen fracture test augmented by finite element analysis, 10:11371 (J;US)
Strenge, D.L., *See* Gore, B.F., 10:11168
Strom, L., Aerosol instrumentation for the Marviken aerosol transport tests, 10:11131 (J;GB)
Strongin, M., *See* Raaen, S., 10:11360
Stubbins, J., *See* Miley, G., 10:11997
Stull, F.D., *See* Vanka, S.P., 10:11507
Stutzmann, M., *See* Biegelsen, D.K., 10:11037
Suazo, G., Standard operating procedure, gas atmosphere brazing facility/ LAMPF Equipment Test Laboratory, 10:11485 (R;US)
Sudan, R.N., *See* Seyler, C.E., 10:11968
Suenaga, M., Optimization of Nb_3Sn, 10:11481 (R;US)
Sugishita, Ryuichiro, *See* Hamaguchi, Hiroshi, 10:11436
Sulkko, M.L., D-xylose fermentation by fusarium oxysporum and other fungi, 10:11023 (R;FI)
Sulak, L.R., *See* Park, H.S., 10:11828
Sullivan, J., *See* Sevillano, E., 10:11930
Sullivan, K.M., *See* Baker, J.W., 10:10845
See Pandich, T., 10:10855
Sunda, W.G., *See* Jenkins, K.D., 10:11703
Sunier, J.W., *See* DiGiacomo, N.J., 10:11870
Suo-Anttila, A.J., *See* Gronager, J.E., 10:11173
Surhoff, J., *See* Meyer, H.J., 10:11657
Sutter, S.L., Accident-generated radioactive particle source term development for consequence assessment of nuclear fuel cycle facilities, 10:11612 (R;US)
Suzuki, K., *See* Yonehara, M., 10:11271
Svalstad, D., *See* Brandshaug, T., 10:10991
Sventek, V., *See* Herbig, J., 10:12015
Svoboda, R., *See* Park, H.S., 10:11828
Swanson, B.I., *See* Jones, L.H., 10:11772, 10:11787
Sweedler, R., *See* Barkas, W.H. II, 10:11015
Sweet, E.A., *See* King, D.W., 10:12026, 10:12027, 10:12029
Swenson, P.A., Role of the supX gene in sensitizing Salmonella typhimurium cells to respiration shutoff induced by far ultraviolet irradiation, 10:11684 (J;GB)
Symons, T.J.M., *See* Gould, H., 10:11551

T

Taber, M., *See* Cabrera, B., 10:11490
Tajima, H., Development of fuel cell technology for industrial applications, 10:11252 (RA;US)
Takahashi, H., *See* Grand, P., 10:11540
Takeshita, S., *See* Horiuchi, N., 10:11272
Tamura, K., *See* Akimaru, S., 10:11267
See Kodama, T., 10:11269
Tamura, T., Progress in research, November 1, 1983-October 31, 1984, 10:11887 (R;US)
Tanaka, Akira, Apparatus for denitration of uranyl nitrate and/or plutonium nitrate, 10:10956 (TG;US)
Tanaka, Katsuyuki, *See* Tanaka, Akira, 10:10956
Tang, W.M., *See* Connor, J.W., 10:11969

Tanis, J.A., Resonant electron transfer and excitation in two, three, and four electron sub20Casupq+ and sub23Vsupq+ ions colliding with helium, 10:11781 (J;US)
Tapping, R.L., Effect of neutralization on protectiveness of sulfide films on carbon steel, 10:11007 (J;US)
Tarbell, W.W., Behavior of core debris ejected from a pressurized vessel into scaled reactor cavities, 10:11172 (R;US)
Tarrago, X., *See* Jacquet, D., 10:11886
Tasaka, K.G.D.L., *See* Hanson, G.H., 10:11132
Tatchyn, R., Outline of a variational formulation of zone-plate theory, 10:11574 (J;US)
Taylor, B.R., *See* Beer, J.M., 10:11013
Taylor, E.J., *See* Jalan, V., 10:11261
Taylor, R.N., *See* Denholm, W.T., 10:10926
Taylor, T.N., *See* Srinivasan, S., 10:11262
Taylor, T.W., *See* Chowdhury, D.P., 10:11807
Teague, M.R., Image formation in terms of the transport equation, 10:11918 (R;US)
Teare, J.D., *See* Beer, J.M., 10:11013
Telfer, A., *See* Bennett, A.J.R., 10:10917
Teller, E., Widespread after-effects of nuclear war, 10:11613 (J;GB)
Terrell, J., 1973 x-ray transient V0332+53, 10:11745 (J;US)
Terry, J.L., *See* Lipschultz, B., 10:11964
See Rice, J.E., 10:11959
Terstriep, M.L., *See* Lee, M.T., 10:10884
Tester, M.A., *See* Henke, B.L., 10:11575
Tetreault, D.J., *See* Berman, R.H., 10:11951
Theil, E., Diagnostics for the NBETF actively cooled beamdump, 10:11977 (R;US)
Thelen, V.N., *See* Garcia, A.S., 10:11482
Thevenin, J.C., *See* Fessler, H., 10:11564
Thieberger, P., *See* Gould, H., 10:11551
Thielges, J.R., *See* Slagle, O.D., 10:11128
Thomas, C.E., *See* Bell, J.D., 10:11965
Thomas, G., *See* van Tendeloo, G., 10:11399
Thomas, J., *See* Binnie, D.M., 10:11557
Thomas, J.M., Characterization of chemical waste site contamination and its extent using bioassays, 10:11618 (R;US)
Thomas, M.G., Grid-connected PV systems: How and where they fit, 10:11044 (RA;US)
Thomas, P., Experimental determination of the atmospheric dispersion parameters at the Karlsruhe Nuclear Research Center for 160 m and 195 m emission heights. Pt. 2, 10:11610 (R;DE)
Thomas, V.W., Assembly, operation and disassembly manual for the Battelle Large Volume Water Sampler (BLVWS), 10:11637 (R;US)
Thomassen, K.I., *See* Stacey, W.M., 10:11989
Thomlinson, W., Characteristics of synchrotron radiation, 10:11539 (R;US)
Thompson, J.D., Kondo-lattice—mixed-valence resistance scaling in heavy-fermion $CeCu_6$ under pressure, 10:11359 (J;US)
See Willis, J.O., 10:11357
Thompson, J.R., *See* Sekula, S.T., 10:11330
Thompson, L.H., *See* Dillehay, L.E., 10:11646
Thompson, M.J., *See* Biegelsen, D.K., 10:11037
Thompson, M.O., Evidence for as doping effects on resolidification dynamics during pulsed laser melting, 10:11412 (R;US)
See Peercy, P.S., 10:11349
Thompson, P., *See* Collick, B., 10:11831
Thompson, P.B., *See* Uckan, N.A., 10:11981
Thompson, R., *See* Biegelsen, D.K., 10:11037
Thorn, C.B., *See* Field, R.D., 10:11838
Thornton, S.T., *See* Shapira, D., 10:11868
Thorp, J.M., *See* Dana, M.T., 10:11593
Tillerson, J.R., Geoengineering properties of potential repository units at Yucca Mountain, southern Nevada, 10:10989 (R;US)
Timm, U., *See* Behrend, H.J., 10:11815
Timmerman, C.L., *See* Buelt, J.L., 10:10979
Tinnel, E.P., *See* Petrich, C.H., 10:11197
Tinney, L.R., *See* Shines, J.E., 10:11623
Tippens, W.B., *See* Glass, G., 10:11829
Tischler, J.Z., Time resolved x-ray studies during pulsed laser irradiation of Ge, 10:11329 (R;US)
See Larson, B.C., 10:11405
Tleel, R., *See* Rybicki, E.F., 10:10950
To, W.M., *See* Koseff, J.R., 10:11506
Tobey, R.A., *See* Seagrave, J.C., 10:11700
Todd, A.M.M., Monte-Carlo study of ICRF-sustained mode operation in tandem mirrors, 10:11957 (J;AT)
Todd, J.A., *See* Ritchie, R.O., 10:11335
Tokar, R.L., *See* Feldman, W.C., 10:11755
Tolman, E.L., *See* McPherson, G.D., 10:11142
Tomazic, W.A., *See* Hulligan, D.D., 10:11317
Tominaga, Y., *See* Pelroy, R.A., 10:11702
Tomlinson, J.J., Latent heat storage in cooling systems, 10:11286 (R;US)
Overview of latent storage for passive solar applications, 10:11061 (R;US)
Tomozawa, M., Properties of glasses with high water content. Final report, June 14, 1979-September 14, 1983, 10:11408 (R;US)
Tong, S.Y., Interaction of low energy electrons with surface lattice vibrations. Final report, 10:11764 (R;US)
Tonutti, M., *See* Comminchau, V., 10:11559
Toof, J.L., *See* Lew, H.G., 10:10924
Torquato, S., Microstructure of two-phase random media. V. The n-point matrix probability functions for impenetrable spheres, 10:11920 (J;US)
Trabalka, J.R., *See* Garten, C.T. Jr., 10:11619
Train, R.E., Corporate use of information regarding natural resources and environmental quality, 10:11186 (R;US)
Trapp, J.A., *See* Carlson, K.E., 10:11154
Travelli, A., US RERTR Program: overview, status and plans, 10:11134 (R;US)
Traylor, R.Y., Prediction of quality and quantity of open pit mine flow from saturated abandoned underground mine workings, 10:10903 (RA;US)
Treadwell, E., *See* Simpson, J., 10:11536
Trebes, J.E., *See* Matthews, D.L., 10:11499
Trevor, D.J., *See* Pollard, J.E., 10:11788
Tripard, G.E., *See* Glass, G., 10:11829
Troc, R., Critical magnetic behavior of triuranium tetraphosphide U_3P_4, 10:11403 (J;DE)
Truelove, J.S., *See* Wall, T.F., 10:10928
Truesdale, C.M., *See* Lindle, D.W., 10:11789
Truhlar, D.G., *See* Brown, F.B., 10:11447
Trulsen, J., *See* Sevillano, E., 10:11930
Trusty, R.M., Field measurement of tension in a T-142 tank track, 10:11488 (R;US)
Tsai, C.C., *See* Biegelsen, D.K., 10:11037
Tsang, K.L., *See* Chen, Y., 10:11398
Tsang, Y.W., Effects of fracture roughness on fluid flow through a single deformable fracture, 10:11725 (R;US)
Tsao, H., Maximum ratio: a tool for assisting inaccuracy assessment, 10:12031 (J;US)
Tsao, J.Y., *See* Thompson, M.O., 10:11412
Tschantz, B.A., *See* Dickens, P.S., 10:10881
Tserruya, I., *See* Meron, M., 10:11759
Tsukamoto, K., *See* Sakai, T., 10:11268
Tsurutani, B.T., Drift mirror mode waves in the distant (X = 200 R/sub e/) magnetosheath, 10:11758 (J;US)
See Gosling, J.T., 10:11756
See Hones E.W. Jr., 10:11752
See Scarf, F.L., 10:11753
See Scholer, M., 10:11751
See Smith, E.J., 10:11754
Tsutsumi, Y., *See* Akimaru, S., 10:11267
Tunnah, B.G., Industrial energy management, 10:11304 (RA;US)
Turko, B.T., Fast readout of CCD images, 10:11517 (R;US)
Turner, J.E., Studies of a digital approach to neutron dosimetry and microdosimetry, 10:11903 (R;US)
Turner, M.S., Superheavy magnetic monopoles and the standard cosmology, 10:11738 (R;US)
Turner, R.E., *See* Rosen, M.D., 10:11498
Turner, R.H., Mobilizing the masses in China, 10:11718 (RA;US)
Turner, R.S., Areas with forest soils sensitive to acidic deposition under alternative damage hypotheses, 10:11617 (R;US)
Tyrrell, J., Chemistry of carbonyl sulfide, 10:11442 (RA;US)
Tzeng, W., *See* Linn, S.H., 10:11770

U

Uckan, N.A., Conceptual design for ELMO Bumpy Square, 10:11981 (RA;US)
Field error calculations in an ELMO Bumpy Square (EBS), 10:11980 (RA;US)
Reactor assessments of advanced bumpy torus configurations, 10:11982 (RA;US)
Ripple effects in ELMO Bumpy Square, 10:11979 (RA;US)
Uckan, T., *See* Uckan, N.A., 10:11980
Uemura, Y.J., *See* Shirane, G., 10:11354

Uesaka, M., Equilibrium and non-equilibrium microfireball behaviour in light-ion fusion systems, 10:11986 (J;AT)
Ullmann, J.L., Pion inelastic scattering to giant resonances and low-lying collective states in ^{118}Sn and ^{40}Ca, 10:11878 (J;US)
Ullrich, R.L., *See* Adams, L.M., 10:11680
Ullrich, S.O. Jr., Survival, respiration, and food assimilation of Daphnia magna exposed to petroleum- and coal-derived oils at three temperatures, 10:11704 (J;CA)
Ulrich, R.K., Initiation of single corrosion sites on iron by focused laser illumination, 10:11372 (J;GB)
Upadhyaya, B.R., BWR stability monitoring using neutron noise, 10:11091 (R;US)
Upfold, R.W., Mine ventilation subsequent to explosions and fires, 10:10897 (R;AU)
Uppuluri, V.R.R., *See* Sobel, M., 10:11667
Upson, C.D., *See* Koseff, J.R., 10:11506
Urbina, C., *See* Martinis, J.M., 10:11914
Ushimaru, K., *See* Case, G.D., 10:10867

V

Valenzuela, J.A., *See* Block, D.L., 10:11050
Valle, P., *See* Coppola, C., 10:10960, 10:11102
Van Bibber, K., *See* Griffioen, K.A., 10:11885
Van Dam, J.W., *See* Spong, D.A., 10:11963
van der Velde, J.C., *See* Park, H.S., 10:11828
Van Hove, M.A., *See* Saldin, D.K., 10:11909
van Rij, W.I., *See* Beasley, C.O., 10:11954
van Rooyen, D., *See* Bandy, R., 10:11327
van Tendeloo, G., Electron microscopy investigation of the ZrO_2-ZrN system. II. Tetragonal and monoclinic ZrO_2 precipitation, 10:11399 (J;US)
Vandegrift, G.F., Influence of basalt/groundwater interactions on radionuclide migration, 10:10998 (R;US)
Vandermeer, R.A., Beta-to-alpha phase transformation in a uranium alloy, 10:11352 (R;US)
Vane, C.R., Ultrahigh-resolution studies of heavy-ion-induced x-ray satellite emission, 10:11763 (R;US)
See Rosseel, T.M., 10:11762
Vanier, P.E., Investigation of gap states in a-Si:H using dual beam photoconductivity and photoluminescence, 10:11387 (R;US)
Vanka, S.P., Block-implicit multigrid solution of Navier-Stokes equations in primitive variables, 10:11803 (R;US)
Mixing, chemical reaction and flow field development in ducted rockets, 10:11507 (R;US)
Vann Kann, F.J., *See* Buckingham, M.J., 10:10889
Varsanik, R.G., Generation and behavior of metal oxide colloids in PWR steam systems, 10:11097 (R;US)
Vary, J.P., *See* Bozzolo, G., 10:11894
Vater, P., *See* Dersch, G., 10:11873
Vaysberg, O.L., *See* Omelchenko, A.N., 10:11748
Venhuizen, J.R., *See* Shimeck, D.J., 10:11140
Venturini, E.L., *See* Azevedo, L.J., 10:11411
Verosub, K.L., Use of volunteer observers to detect abnormal animal behavior prior to earthquakes, 10:11717 (RA;US)
Veselick, E., *See* Cox, E., 10:11627
Vesely, P., LR-0 research reactor experimental fuel production control, 10:11135 (RA;DE;In Russian)
Vial, N.M., *See* Hochard, G.P., 10:11103
Viens, D., *See* Schulson, E.M., 10:11369
Vijayaraghavan, R., *See* Balaramamoorthy, K., 10:11110
Vineyard, G.H., Effect of a magnetic field on the vibrations of an ionic lattice, 10:11908 (J;US)
Virkar, A.V., Some aspects of breakdown of β''-alumina solid electrolyte, 10:11181 (J;GB)
See Viswanathan, L., 10:11180
Viswanathan, L., Wetting characteristics of sodium on β''-alumina and on nasicon, 10:11180 (J;GB)
Vogt, O., *See* Lander, G.H., 10:11361
Voigt, K., Chemical vapour deposition coating of hard metals with special reference to boron and boron compounds, 10:11343 (R;GB)
Vollath, D., Physical methods of quality control of fuel pellets, 10:10962 (RA;DE)
Practical experience in the application of quality control in water-reactor fuel fabrication, 10:11099 (R;DE)
Voter, A.F., Dynamical corrections to transition state theory for multistate systems: Surface self-diffusion in the rare-event regime, 10:11446 (J;US)
Vowell, R.C., Crab waste methane digester. Final report, 10:11014 (R;US)

W

Wachtendonk, H.J. von, Determination of the U-235-content in UF_6 within the shipment container, 10:11005 (RA;DE)
Measurement of the inner pressure of a fuel rod and determination of the filling gas purity, 10:11086 (RA;DE)
See Vollath, D., 10:10962
Wackerle, J., Burning topology in the shock-induced reaction of heterogeneous explosives, 10:11584 (BA;US)
Wadsworth, J., *See* Stocks, G.M., 10:11328
Wadt, W.R., Ab initio effective core potentials for molecular calculations. Potentials for main group elements Na to Bi, 10:11779 (J;US)
See Hay, P.J., 10:11778, 10:11780
Wagner, R., *See* Diebold, R., 10:11813
Wagner, R.A., *See* Osnes, J.D., 10:11723
Wagner, R.D., Low mileage catalyst evaluation with a methanol-fueled Rabbit - second interim report. Technical report, 10:11319 (R;US)
Wagner, R.J., Potential for interactive/real time nuclear power plant simulation with RELAP5, 10:11144 (R;US)
Wagner, R.P., *See* Bowersox, D.F., 10:11430
Wald, J.W., *See* Weber, W.J., 10:10981
Waldeck, D.H., *See* Alivisatos, A.P., 10:11775
Waldman, H., Measured data from the Avery Island Site C heater test, 10:10967 (R;US)
Walker, J.T., *See* Freytag, D.R., 10:11552
Walker, R.L., *See* Garten, C.T. Jr., 10:11619
Wall, T.F., Combustion and heat transfer in pulverised coal fired furnaces, 10:10928 (R;AU)
Wallace, G., *See* O'Connell, R.F., 10:11910
Wallraff, W., *See* Althoff, M., 10:11818
Walton, J.J., *See* MacCracken, M.C., 10:11597
Walton, O.R., Granular flow project. Quarterly report, October-December 1984, 10:11477 (R;US)
Wambsgans, M.W., The state-of-the-art in understanding and solving flow induced vibration problems in shell-and-tube heat exchangers, 10:11526 (BA;US)
Wang, C.L., *See* Buchanan, W., 10:11231
Wang, H.H., *See* Azevedo, L.J., 10:11411
Wang, P., *See* Rudaz, S.L., 10:11418
Wang, R., *See* Merz, M.D., 10:11345
Wanner, T., Optimal linear filters for radiometric transport belt balances, 10:11561 (R;DE;In German)
Ward, P.L., Use of volunteers in the earthquake-hazards-reduction program: proceedings of conference IV, 10:11715 (R;US)
Ward, R.C., Analysis of uncertainties in CRAC2 calculations: wet deposition and plume rise, 10:11608 (R;US)
Warinner, D.K., *See* Woodruff, W.L., 10:11159
Warren, L.J., *See* Bennett, A.J.R., 10:10917
Waters, L.C., Studies on the relationship between dimethylnitrosamine-demethylase activity and dimethylnitrosamine-dependent mutagenesis in Drosophila melanogaster, 10:11711 (J;NL)
Watson, D.F., *See* Phillip, G.M., 10:10891
Watson, E.B., *See* Tomozawa, M., 10:11408
Watson, G.S., *See* Bloomfield, P., 10:10934
Watson, J.S., Potential resources from coal fly ash, 10:10863 (R;US)
Watterson, R., *See* Lipschultz, B., 10:11964
Weaver, T.A., *See* Matthews, D.L., 10:11499
Weber, M.J., Computer simulations of rare earth sites in glass: experimental tests and applications to laser materials, 10:11413 (R;US)
Weber, W.J., Effects of alpha irradiation on barium hollandite and nickel-iron spinel, 10:11410 (R;US)
Self-radiation damage in actinide host phases of nuclear waste forms, 10:10981 (R;US)
Weeks, R.A., *See* Sonder, E., 10:11396
Wegner, H., *See* Gould, H., 10:11551

Wehner, A.P., Lund clearance of neutron-activated Mount St. Helens volanic ash in the rat, 10:11688 (J;US)
Lung changes in rats inhaling volcanic ash for one year, 10:11712 (J;US)
Wei, C.H., Crystallization of two cubic forms of soybean trypsin inhibitor E-I, a member of the Bowman-Birk inhibitor family, 10:11643 (J;US)
Weidinger, H.G., Methods of quality control for Zircaloy tubing, 10:11105 (RA;DE)
Weingart, J.M., *See* Curtis, R.B., 10:11285
Weizer, V.G., *See* Goradia, C., 10:11039
Welch, D.R., Proton spectra diagnostics for shock-compression studies, 10:11956 (J;US)
Welch, M.J., *See* Kiesewetter, D.O., 10:11660
Wellner, R., *See* Meyer, H.J., 10:11657
Wendroff, B., *See* Stewart, H.B., 10:11510
Werth, J., *See* Brand, M.J., 10:11258
See Buchanan, W., 10:11231
Weston, A.M., Model for high rate gas flows in deformable and reactive porous beds, 10:11582 (R;US)
Westphal, H., *See* Voigt, K., 10:11343
Wette, M., *See* Laub, A.J., 10:11929
Wheeler, G.F., *See* Patel, J.G., 10:10829
Whelan, J.A., *See* Buchanan, W., 10:11231
Whisnant, K., *See* Moore, S.R., 10:11847
Whitcomb, J.H., *See* Rundle, J.B., 10:11727
White, C.W., *See* McHargue, C.J., 10:11388
White, D., *See* Hirst, E., 10:11292
Whitley, J.B., Fusion reactor materials. Pt. A. Proceedings, 10:11988 (B;NL)
Whitten, B.L., *See* Matthews, D.L., 10:11499
See Rosen, M.D., 10:11498
Wibberley, L.J., *See* Wall, T.F., 10:10928
Wicksted, J.P., *See* Shirane, G., 10:11354
Wiederkehr, R.R.V., *See* King, D.W., 10:12026, 10:12027, 10:12029
Wiffen, F.W., Materials engineering for TFCX, 10:11975 (R;US)
See Conn, R.W., 10:11993
See Scott, J.L., 10:11974
Wilborn, J., *See* Griswold, J.W., 10:11243
Wilczynski, J., Investigation of the neutron-proton-interaction in the energy range from 20 to 50 MEV, 10:11824 (R;DE;In German)
Wilemski, G., Molten carbonate fuel cell performance model update. Quarterly report, April-June 1984. Draft, 10:11276 (R;US)
PSI: mechanistic fuel cell modeling, 10:11249 (RA;US)
Wilerson, C.L., *See* Wehner, A.P., 10:11688
Wiles, R.A., New publications for road systems at coal mines, 10:10902 (RA;US)
Wiley, J.D., *See* Dobisz, E.A., 10:11350
Wilhelm, W.G., Brookhaven National Laboratory's low cost solar technology, 10:11054 (R;US)
Wilkening, M., Source characterization and transport process affecting levels of radon and its decay products in an indoor environment. Final technical report, 10:11609 (R;US)
Wilkinson, F.J. III, *See* Medley, S.S., 10:11943
Willard, A.G., *See* Burdon, R.G., 10:10916
Willett, J.E., Parametric decay of Langmuir waves in an electron beam-plasma system, 10:11971 (J;GB)
Williams, J.M., *See* Azevedo, L.J., 10:11411
See Kwak, J.F., 10:11915
Williams, R.K., Study of the Kondo effect and intrinsic electrical conduction in titanium diboride, 10:11397 (J;US)
Williams, R.S., *See* Lince, J.R., 10:11324
Williams, S., Cerenkov ring imaging detector development for SLD, 10:11570 (R;US)
Williams, T.E., Industrial energy efficiency reporting: a bridge to information transfer, 10:11211 (BA;CA)
Williams, T.L., INEL User Network Exchange. Volume 1-85, Jan./Feb. 1985, 10:12011 (R;US)
Willis, J.O., Effect of pressure on spin fluctuations and superconductivity in heavy-fermion UPt_3, 10:11357 (J;US)
Willis, L.F., Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 12, Appendix L: laws, regulations, and guidelines, 10:11202 (R;US)
Wilson, B.W., *See* Chess, E.K., 10:10862
See Later, D.W., 10:10861
Wilson, J.W., Human exposure in low Earth orbit, 10:11904 (R;US)
Wilson, K.L., *See* Whitley, J.B., 10:11988
Wilson, M.L., *See* Englert, S.B., 10:11148
Wilson, W.E., Mean delta-ray energies in ion-molecule collisions, 10:11900 (R;US)
Monte Carlo calculation of energy deposition and ionization yield for high energy protons, 10:11901 (R;US)
Wilt, M.D., *See* Trusty, R.M., 10:11488
Winicur, D.H., *See* Coyle, D.E., 10:11801
Winkeler, P.W., *See* Kern, R.D., 10:11475
Winkelmann, F.C., *See* Curtis, R.B., 10:11290
Winston, R., Fundamentals and techniques of nonimaging optics. Final report, 10:11057 (R;US)
Winter, G.G., *See* Behrend, H.J., 10:11815
Wire, M.S., Phase stability and magnetic properties of UAl_2 based pseudobinary spin fluctuation compounds, 10:11341 (R;US)
Wirtenson, G.R., Scaling up the neutral solution antireflection process, 10:11423 (J;US)
Witherspoon, J.P., *See* Pin, F.G., 10:11002
Witherspoon, P.A., *See* Tsang, Y.W., 10:11725
Witschi, H.P., *See* Haschek, W.M., 10:11708
Witschi, H.R., *See* Hakkinen, P.J., 10:11693
Witten, A.J., *See* Eraslan, A.H., 10:11123
Wittmaack, K., Hitherto and future use of the accelerators of the PTA, 10:11531 (R;DE;In German)
Wodkiewicz, K., Noise in strong laser-atom interactions: Frequency fluctuations and nonexponential correlations, 10:11798 (J;US)
See Eberly, J.H., 10:11795
Wogman, N.A., *See* Brodzinski, R.L., 10:11566
Wojcicki, S.G., *See* Hwa, T., 10:11534
Wolcott, D.R., Appropriate Technology Small Grants Program: an evaluation. Volume I. Report, 10:11220 (R;US)
Appropriate Technology Small Grants Program: an evaluation. Volume II. Appendix, 10:11221 (R;US)
Wolf, E.L., *See* Noer, R.J., 10:11420
Wolf, J.R., *See* Englert, S.B., 10:11148
Wolfe, S., *See* Greenwald, M., 10:11976
Wolfe, S.M., *See* Lipschultz, B., 10:11964
Wolfsberg, K., Molybdenum solar neutrino experiment, 10:11740 (R;US)
Wolin, M.J., *See* Demacario, E.C., 10:11661
Wolitzer, D., *See* Rodrigue, G., 10:12021
Wolsky, A.M., *See* Gaines, L.L., 10:11010
Wong, C.F., Application of R-matrix theory to resonant reactive electron-molecule scattering: Vibrational excitation and dissociative attachment of N_2 and F_2, 10:11797 (J;US)
Wong, K.L., *See* Goree, J., 10:11944, 10:11946
See Skiff, F., 10:11945
Wood, R.F., *See* Lowndes, D.H., 10:11406
Woodruff, W.L., Radiological consequence analysis with HEU and LEU fuels, 10:11159 (R;US)
Woods, G., *See* Bennett, A.J.R., 10:10917
Woodworth, J.G., *See* Griffioen, K.A., 10:11885
Woosley, S.E., High energy transients in astrophysics , 10:11746 (B;US)
Worlton, W.J., *See* Rudsinski, L.E., 10:12014
Wright, A.L., *See* Petrykowski, J.C., 10:11156
Wright, C.W., *See* Chess, E.K., 10:10862
See Later, D.W., 10:10861
Wright, H.A., *See* Turner, J.E., 10:11903
Wright, M.H., *See* Gill, P.E., 10:12016
Wright, T., *See* Tsao, H., 10:12031
Wright, W.L., *See* Uckan, N.A., 10:11981
Wu, C.H., *See* Kern, R.D., 10:11475
Wu, F.F., Critical review of external network modelling for online security analysis, 10:11071 (J;GB)
Wuest, C., *See* Park, H.S., 10:11828
Wurth, R., *See* Albrecht, H., 10:11816
Wynveen, R.A., *See* Cooke, R.H., 10:11542
Wypych, P.W., *See* Arnold, P.C., 10:10918

Y

Yahya, E., Density of gap states in hydrogenated amorphous silicon, 10:11409 (R;US)
Yan, D.S., *See* Burdon, R.G., 10:10916
Yang, E.S., *See* Panayotatos, P., 10:11041
Yang, J.W., Analysis of ex-vessel debris/water interaction and a potential overpressurization of containment, 10:11139 (R;US)
Yao, N.P., *See* Minh, N.Q., 10:11466
See Poa, D.S., 10:11179
Ybarrondo, L.J., *See* Wagner, R.J., 10:11144
Yearian, M.R., *See* Griffioen, K.A., 10:11885
Yeh, Y.S., Normal anatomy and aneurysms of middle cerebral artery. A morphological, neuroradiological and clinical study, 10:11649 (R;DE)
Yellin, S., *See* Williams, S., 10:11570
Yen, W.M., Protection of Lexan from uv radiation by photodownconversion. Final report, 10:11056 (R;US)

Yi-Cheng, Z., *See* Parisi, G., 10:11843, 10:11844
Yonehara, M., Operational experiences of 30 kW phosphoric acid fuel cell power plant, 10:11271 (RA;US)
Yoon, R.H., Preparation of super-clean coal. Technical progress report for third and fourth quarters, March 15, 1984-September 14, 1984, 10:10911 (R;US)
Yost, D.M., *See* Naegeli, D.W., 10:11320
Young, B., *See* Moore, S.R., 10:11847
Young, J.P., *See* Rosseel, T.M., 10:11762
Young, M.F., *See* Mehlhorn, T.A., 10:11902
Yow, J.L. Jr., Geologic structure mapping database Spent Fuel Test - Climax, Nevada Test Site, 10:10992 (R;US)
Yu, H., *See* Yen, W.M., 10:11056
Yudkowsky, M., Nuclear-magnetic-resonance study of electronic structure in the copper-niobium superlattice, 10:11356 (J;US)

Z

Zaider, M., Application of track calculations to radiobiology. III. Analysis of the molecular beam experiment results, 10:11677 (J;US)
Stochastic treatment of fast chemical reactions, 10:11472 (J;US)
Zamora, P.O., Cytotoxicity and mutagenicity of vapor-phase pollutants in rat lung epithelial cells and Chinese hamster ovary cells grown on collagen gels, 10:11697 (J;US)
Zeh, C.M., Computer-based fuel cell analytical tools: description and availability, 10:11247 (RA;US)
Zeng, D.L., *See* Kestin, J., 10:11802
Zesch, J.C., *See* Biegelsen, D.K., 10:11037
Ziegler, N.F., Observations on the Munich MP arc discharge conditioning test, 10:11530 (R;US)
Zielinski, M., *See* Collick, B., 10:11831
Zimmerman, G.P., High explosive testing of a corrugated metal blast shelter with membrane blast doors, 10:11581 (R;US)
Zitter, H., *See* Bleckmann, I., 10:11386
Zoeller, U., *See* Ehrhardt, J., 10:11165
Zvirin, Y., *See* Mertol, A., 10:11068
Zwicki, R.D., *See* Scholer, M., 10:11751, 10:11757
See Tsurutani, B.T., 10:11758
Zwickl, R.D., *See* Crooker, N.U., 10:11750
See Gosling, J.T., 10:11756
See Hones E.W. Jr., 10:11752

SUBJECT INDEX

The subject index is based on the use of subject descriptors selected from a controlled thesaurus of terms (DOE/TIC-7000). Subject descriptors and qualifiers (subheadings) are selected and presented in the following format:

SUBJECT DESCRIPTOR
Qualifier
Title, (supplementary information), citation number, (R;US)

The notations in the final parentheses indicate the type of document, e.g., R for Report; the country of publication, e.g., US; and the language if other than English, e.g., In German. Tables of document types and country of publication codes appear after the indexes.

The title may be supplemented with additional words, or a phrase, if it appears additional information would be helpful. In cases for which the title contains little or no information related to the subject entry, it may be replaced entirely by the supplementary information. A qualifier is not always required, and in such cases the title will follow the unqualified subject descriptor.

The descriptors selected for use as subject terms are generally the names of specific materials, things, or processes. To the extent possible, a qualifier is selected to describe the properties of, or processes applied to, the subject term.

Index entries are selected to indicate the important ideas and concepts presented in a document, rather than words that may appear in the text. Within the available thesaurus terms, the most probable or logical place to look for typical information is selected. "See references" are included to guide users from synonymous terms or phrases to the descriptor selected as a subject heading for the concept (e.g., Pipeline Quality Gas, see HIGH BTU GAS). "See also references" are used to indicate where to find references to subject concepts that are narrower, broader, or related to a particular subject heading. To complete an exhaustive search of a given subject, all such headings should be reviewed. Copies of DOE/TIC-7000, the Subject Thesaurus, are available from the National Technical Information Service (NTIS), U.S. Department of Commerce, Springfield, VA 22161.

A

ABANDONED SITES
Hydrology
Prediction of quality and quantity of open pit mine flow from saturated abandoned underground mine workings, 10:10903 (RA;US)

ABSORBERS (SOLAR)
See SOLAR ABSORBERS

ACCELERATOR BREEDERS
Feasibility Studies
Breeding nuclear fuels with accelerators: replacement for breeder reactors, 10:11540 (R;US)

ACCELERATOR FACILITIES
See also STANFORD LINEAR COLLIDER
Experimental studies of elementary particle interactions at high energies. Technical progress report, 10:11822 (R;US)
Cherenkov Counters
Cerenkov ring imaging detector development for SLD, 10:11570 (R;US)
Design
D0 Project at Fermilab, 10:11543 (R;US)
Drift Chambers
Design for small angle (0 to 2mr) spectrometer for ep or anti pp collisions at DO, 10:11560 (R;US)
Magnetic Spectrometers
Design for small angle (0 to 2mr) spectrometer for ep or anti pp collisions at DO, 10:11560 (R;US)
Multiwire Proportional Chambers
Design for small angle (0 to 2mr) spectrometer for ep or anti pp collisions at DO, 10:11560 (R;US)
Radiation Protection
Radiological safety at Argonne National Laboratory's heavy ion research facility, 10:11542 (R;US)

ACCELERATORS
See also COLLECTIVE ACCELERATORS
ELECTROSTATIC ACCELERATORS
LINEAR ACCELERATORS
RAILGUN ACCELERATORS
Permanent Magnets
Application of permanent magnets in accelerators and electron storage rings, 10:11532 (R;US)

ACCIDENTAL IRRADIATION
See RADIATION ACCIDENTS

ACES
See QUARKS

ACETIC ACID ESTERS
Synthesis
Biomass chemical production by thermochemical conversion, 10:11040 (J;US)

ACETYLENE
Pyrolysis
Identification and temporal behavior of radical intermediates formed during the combustion and pyrolysis of gaseous fuels: kinetic pathways to soot formation. Progress report, September 1, 1982-June 30, 1985, 10:11475 (R;US)

ACID ELECTROLYTE FUEL CELLS
Anodes
Carbon monoxide tolerant anodes and freeze resistant electrodes, 10:11259 (RA;US)
Catalyst Supports
Advanced electrocatalysts and supports for phosphoric acid fuel cells, 10:11261 (RA;US)
Carbon corrosion in hot phosphoric acid fuel cells, 10:11263 (RA;US)
Design
Integrated energy systems for buildings, 10:11231 (RA;US)
Phosphoric and electric utility fuel cell technology development. Technical progress report No. 18, October 1984, 10:11277 (R;US)
Economic Analysis
Fuel cell power system for forklift trucks, 10:11258 (RA;US)
Electrocatalysts
Advanced electrocatalysts and supports for phosphoric acid fuel cells, 10:11261 (RA;US)
Electrocatalyst advances for hydrogen oxidation in phosphoric acid fuel cells, 10:11281 (J;GB)
Electrochemical and surface science research on fuel cells, 10:11262 (RA;US)
Electrochemistry
Electrochemistry of fuel cells for transportation applications, 10:11280 (J;GB)
Electrochemical and surface science research on fuel cells, 10:11262 (RA;US)
Electrolytes
Advanced electrolytes for acid fuel cells: an overview, 10:11264 (RA;US)
Fabrication
Phosphoric acid electric utility fuel cell technology development. Technical progress report No. 16, August 1984, 10:11275 (R;US)

Freeze Protection
Carbon monoxide tolerant anodes and freeze resistant electrodes, 10:11259 (RA;US)
Operation
Operational experiences of 30 kW phosphoric acid fuel cell power plant, 10:11271 (RA;US)
Optimization
R and D of phosphoric acid fuel cell technologies and systems for a dispersed power plant, 10:11266 (RA;US)
Performance
Development of 50 kW fuel cell power plant, 10:11268 (RA;US)
Performance Testing
Phosphoric acid electric utility fuel cell technology development. Technical progress report No. 16, August 1984, 10:11275 (R;US)
Phosphoric and electric utility fuel cell technology development. Technical progress report No. 18, October 1984, 10:11277 (R;US)
Reformer Processes
High pressure type PAFC development for concentrated generation, 10:11267 (RA;US)
Research Programs
Small methanol powerplant progress, 10:11257 (RA;US)
Technology Assessment
Acid fuel cell technology: an overview, 10:11228 (RA;US)
Uses
Development of PAFC system and its application to industrial use, 10:11253 (RA;US)

ACID MINE DRAINAGE
Solvent Properties
Prediction of quality and quantity of open pit mine flow from saturated abandoned underground mine workings, 10:10903 (RA;US)
Water Pollution
Effects of coal mining on ground-water quality in West Virginia, 10:10882 (RA;US)
Water Treatment
Simplified modeling of slurry impoundment effluent water quality, 10:10871 (RA;US)

ACID RAIN
Biological Effects
Acidic precipitation effects on crops: a review and analysis of research, 10:11690 (J;US)
Environmental Impacts
Areas with forest soils sensitive to acidic deposition under alternative damage hypotheses, 10:11617 (R;US)
Environmental Policy
Integration of energy/economic models for environmental assessments and policy analysis, 10:11184 (R;US)
Forecasting
Effects of varying air trajectories on spatial and temporal precipitation chemistry patterns, 10:11606 (J;NL)
Public Policy
Acid rain and transported air pollutants: implications for public policy, 10:11614 (R;US)
Regional Analysis
Acid precipitation: natural versus anthropogenic components, 10:11600 (J;US)
Water Pollution
Acid rain and forestry, 10:11591 (R;GB)

ACIDS (ORGANIC)
See ORGANIC ACIDS

ACOUSTICS
Data Processing
Parametric coherence estimation via convolved correlations, 10:11928 (R;US)

ACTINIDE NUCLEI
See also AMERICIUM 241
NEPTUNIUM 237
PLUTONIUM 239
PLUTONIUM 240
PLUTONIUM 242
THORIUM 230
THORIUM 232
THORIUM 234
URANIUM 234
URANIUM 235
URANIUM 236
URANIUM 238
Decay
Report on the participation of US laboratories in the work of the IAEA coordinated research program on the measurement and evaluation of transactinium isotope nuclear decay data, 10:11883 (R;US)
Energy-Level Transitions
Report on the participation of US laboratories in the work of the IAEA coordinated research program on the measurement and evaluation of transactinium isotope nuclear decay data, 10:11883 (R;US)

ACTINIDES
See also AMERICIUM
BERKELIUM
CALIFORNIUM
CURIUM
NEPTUNIUM
PLUTONIUM
URANIUM
Magnetic Properties
Magnetism of the heavy 5f elements, 10:11378 (J;CH)

ADAMELLITE
See QUARTZ MONZONITE

ADSORBENTS
See also MOLECULAR SIEVES
Regeneration
[Evaluation of NOXSO combined NO/sub x/ and SO_2 flue gas cleanup]. Monthly progress report, April 1-30, 1983, 10:10865 (R;US)
Evaluation of the NOXSO combined NO/sub x//SO_2 flue gas treatment process: process chemistry, reaction kinetics and sorbent performance. Monthly progress report, March 1, 1983-March 31, 1983, 10:10864 (R;US)

AEROSOLS
See also RADIOACTIVE AEROSOLS
SMOKES
Heterogeneous Catalysis
Neutral and charged clusters in the atmosphere: their importance and potential role in heterogeneous catalysis, 10:11455 (J;US)

AFRICA
See also MOROCCO
SENEGAL
Energy Conservation
Introduction and background, 10:11282 (RA;US)
Overview of the energy situation in ECOWAS countries, 10:11283 (RA;US)
Energy Consumption
Overview of the energy situation in ECOWAS countries, 10:11283 (RA;US)

AIR CONDITIONING
Latent Heat Storage
Latent heat storage in cooling systems, 10:11286 (R;US)

AIR FILTERS
Activated Carbon
Parametric investigations on the retention of methyl iodide by a KI-impregnated activated carbon, 10:11124 (R;DE;In German)

AIR POLLUTION
See also INDOOR AIR POLLUTION
Environmental progress and challenges: an EPA (Environmental Protection Agency) perspective, 10:11189 (R;US)
Long-Range Transport
Effects of varying air trajectories on spatial and temporal precipitation chemistry patterns, 10:11606 (J;NL)

AIR POLLUTION ABATEMENT
Use this term for items that involve the prevention of formation of pollutants at the source.
Environmental Impacts
Acid rain and transported air pollutants: implications for public policy, 10:11614 (R;US)
Socio-Economic Factors
Acid rain and transported air pollutants: implications for public policy, 10:11614 (R;US)

AIR POLLUTION CONTROL
Use this term for items that involve the removal or management of pollutants after they are formed by a source.

Cost
Integration of energy/economic models for environmental assessments and policy analysis, 10:11184 (R;US)
AIR SAMPLERS
Performance Testing
Long-range atmospheric tracer field test, 10:11604 (J;GB)
AIRBORNE PARTICLES
See PARTICULATES
AIRBORNE PARTICULATES
See PARTICULATES
AIRCRAFT FUELS
See AVIATION FUELS
ALASKA
Plants
Development of Northern Plant Documentation Center. Final report, 10:11664 (R;US)
Northern Plant Documentation Center, 1980-1983. Final report, 10:11615 (R;US)
ALCATOR DEVICE
Fuel Pellets
Confinement results from pellet fueled discharges in Alcator C, 10:11976 (R;US)
Plasma Scrape-Off Layer
Marfe: an edge plasma phenomenon, 10:11964 (J;AT)
Power Losses
Marfe: an edge plasma phenomenon, 10:11964 (J;AT)
Reactor Fueling
Confinement results from pellet fueled discharges in Alcator C, 10:11976 (R;US)
ALCOHOLS
See also ETHANOL
GLYCOLS
Biosynthesis
Enzymatic conversion of cellulosic materials to sugars and alcohol: the technology and its implications, 10:11022 (R;AT)
ALDEHYDES
See also FORMALDEHYDE
XYLOSE
Ion Exchange
Studies of cation exchange for the isolation and concentration of trace level components of complex aqueous mixtures, 10:10974 (R;US)
Ion Exchange Chromatography
Selectivity variations in anion chromatography, 10:11428 (R;US)
ALDEHYDO ACIDS
See ALDEHYDES
ALGAE
Anaerobic Digestion
Methane and fertilizer production from seaweed biomass. Final report, 10:11017 (R;US)
ALKALI METAL COMPOUNDS
See also SODIUM COMPOUNDS
Crystal-Phase Transformations
Structure of dense shock-melted alkali halides: Evidence for a continuous pressure-induced structural transition in the melt, 10:11414 (J;US)
Melting
Structure of dense shock-melted alkali halides: Evidence for a continuous pressure-induced structural transition in the melt, 10:11414 (J;US)
Shock Waves
Structure of dense shock-melted alkali halides: Evidence for a continuous pressure-induced structural transition in the melt, 10:11414 (J;US)
ALKALINE FLOODING
See CAUSTIC FLOODING
ALKALINE HYDROLYSIS
Chemical Reaction Yield
Formation of dimethylbenzenediol via acyloin condensation and a reduction-oxidation pathway, 10:11463 (R;US)
ALKYL RADICALS
See also ETHYL RADICALS
METHYL RADICALS
Bond Lengths
Use of alpha hyperfine coupling tensors as a measure of unpaired spin density and free radical geometry, 10:11783 (J;US)
Hyperfine Structure
Use of alpha hyperfine coupling tensors as a measure of unpaired spin density and free radical geometry, 10:11783 (J;US)
Molecular Structure
Use of alpha hyperfine coupling tensors as a measure of unpaired spin density and free radical geometry, 10:11783 (J;US)
ALKYLATES
See ALCOHOLS
ALKYLATING AGENTS
See also ENDOXAN
Toxicity
Zinc effects on glutathione metabolism relationship to zinc-induced protection from alkylating agents, 10:11700 (J;GB)
ALLOY 800
See INCOLOY 800
ALLOY-HD-8077
See NICKEL BASE ALLOYS
ALLOY-HT-9
Physical Radiation Effects
Charpy impact test results of ferritic alloys at fluence to 6 x 10^{23} n/cm , 10:11338 (R;US)
Effects of irradiation on the fracture toughness of HT-9, 10:11337 (R;US)
ALLOY-MA-754
See NICKEL BASE ALLOYS
ALLOYS
See also ALUMINIUM ALLOYS
CHROMIUM ALLOYS
COBALT ALLOYS
COPPER ALLOYS
GERMANIUM ALLOYS
GOLD ALLOYS
HEAT RESISTING ALLOYS
INTERMETALLIC COMPOUNDS
IRON ALLOYS
LEAD ALLOYS
LITHIUM ALLOYS
MANGANESE ALLOYS
MOLYBDENUM ALLOYS
NICKEL ALLOYS
NIOBIUM ALLOYS
SCANDIUM ALLOYS
SILICON ALLOYS
TIN ALLOYS
VANADIUM ALLOYS
YTTRIUM ALLOYS
ZINC ALLOYS
ZIRCONIUM ALLOYS
Creep
Creep crack growth in ductile alloys, 10:11332 (R;US)
Diffusion
Tracer diffusion in an ordered alloy: application of the path probability and Monte Carlo methods, 10:11333 (R;US)
Ion Implantation
Ion implantation metallurgy, 10:11364 (J;US)
ALLOY-WAZ-16
See NICKEL BASE ALLOYS
ALPHA DETECTION
Liquid Scintillation Detectors
Liquid scintillation alpha spectrometry techniques, 10:11572 (J;NL)
ALPHA PARTICLES
Emitted by nuclei.
Distribution Functions
Fast alpha particle distribution function in an open field-line plasma with electrostatic confining potential, 10:11932 (R;US)
ALPHA SPECTROSCOPY
Application of alpha spectrometry to the discovery of new elements by heavy-ion beam bombardment, 10:11864 (J;NL)
ALPHA-BEARING WASTES
Radioactive Waste Disposal
Long-Range Master Plan for Defense Transuranic Waste Management, 10:10972 (R;US)

Radioactive Waste Management
Long-Range Master Plan for Defense Transuranic Waste Management, 10:10972 (R;US)
Underground Disposal
Innovative electrical technique for in-place stabilization of contaminated soils, 10:10979 (R;US)
Vitrification
Innovative electrical technique for in-place stabilization of contaminated soils, 10:10979 (R;US)

ALUMINIA
See ALUMINIUM OXIDES

ALUMINIUM
Bonding
Use of electrodeposition to provide coatings for solid state bonding, 10:11384 (J;US)
Diffusion Welding
Use of electrodeposition to provide coatings for solid state bonding, 10:11384 (J;US)
Electron Emission
Large-angle positronium emission for Al(110), 10:11760 (R;US)
Ion Collisions
Large-angle positronium emission for Al(110), 10:11760 (R;US)
Melting
Sliding-Bed (trademark) aluminum-scrap preheater. Final report, October 1982-May 1984, 10:11310 (R;US)
Oscillator Strengths
H-Division materials physics quarterly report, April-June 1984, 10:11323 (R;US)
Positronium
Large-angle positronium emission for Al(110), 10:11760 (R;US)
Strains
Evaluation of anisotropic effective stress-strain criteria for the biaxial yield and flow of 2024 aluminum tubes, 10:11367 (J;US)
Stress Analysis
Evaluation of anisotropic effective stress-strain criteria for the biaxial yield and flow of 2024 aluminum tubes, 10:11367 (J;US)

ALUMINIUM ALLOYS
See also ALUMINIUM BASE ALLOYS
Brittle-Ductile Transitions
Flow localization accompanying the intergranular fracture of Ni_3Al, 10:11369 (J;US)
Corrosion Resistance
Corrosion resistance of metallic solar absorber materials in a range of heat transfer fluids. Final technical report, 10:11055 (R;US)
Ductility
Ductile ordered intermetallic alloys, 10:11363 (J;US)
Electric Conductivity
Phase stability and magnetic properties of UAl_2 based pseudobinary spin fluctuation compounds, 10:11341 (R;US)
Fabrication
Ductile ordered intermetallic alloys, 10:11363 (J;US)
Fracture Properties
Flow localization accompanying the intergranular fracture of Ni_3Al, 10:11369 (J;US)
Magnetic Properties
Magnetic studies of Ni_3Al(Fe) compounds, 10:11330 (R;US)
Magnetic Susceptibility
Phase stability and magnetic properties of UAl_2 based pseudobinary spin fluctuation compounds, 10:11341 (R;US)
Microstructure
Comparison of the microstructures of as-cast and laser surface melted Ti-8Al-4Y, 10:11366 (J;US)
Phase Stability
Phase stability and magnetic properties of UAl_2 based pseudobinary spin fluctuation compounds, 10:11341 (R;US)
Plasticity
Flow localization accompanying the intergranular fracture of Ni_3Al, 10:11369 (J;US)
Powder Metallurgy
Prospects for low activity aluminium structures, 10:12000 (BA;GB)
Specific Heat
Phase stability and magnetic properties of UAl_2 based pseudobinary spin fluctuation compounds, 10:11341 (R;US)

ALUMINIUM BASE ALLOYS
Aging
Small-angle x-ray scattering (SAXS) study of coarsening kinetics in an aluminum-lithium alloy, 10:11331 (R;US)

ALUMINIUM OXIDES
See also SPINELS
Decomposition
Some aspects of breakdown of β''-alumina solid electrolyte, 10:11181 (J;GB)
Electric Conductivity
Behavior of electrical conduction of spinel and other insulating oxides in moderate electric fields at high temperature, 10:11396 (J;US)
Ion Implantation
Structure and properties of ion-implanted Al_2O_3, 10:11388 (R;US)
Materials Recovery
Potential resources from coal fly ash, 10:10863 (R;US)
Phase Studies
Stable and metastable phase equilibria and reactions in the SiO_2-αAl_2O_3 system, 10:11400 (J;IT)
Sorptive Properties
Evaluation of the NOXSO combined NO/sub x//SO_2 flue gas treatment process: process chemistry, reaction kinetics and sorbent performance. Monthly progress report, March 1, 1983-March 31, 1983, 10:10864 (R;US)
Wetting Agents
Wetting characteristics of sodium on β''-alumina and on nasicon, 10:11180 (J;GB)

ALUMINUM
See ALUMINIUM

ALVEOLI (PULMONARY)
See LUNGS

AMERICAN SAMOA
Energy Source Development
Biomass energy options for the American Territories of the Pacific, 10:11223 (R;US)

AMERICIUM
Adsorption
Characterization of soils at proposed Solid Waste Storage Area (SWSA) 7, 10:11625 (R;US)
Chemistry
Frontiers of chemistry for americium and curium, 10:11473 (R;US)
Separation Processes
Americium transfer studies using hollow fiber/extractant membranes, 10:10986 (R;US)
Solubility
Groundwater chemistry along flow paths between a proposed repository site and the accessible environment, 10:11000 (R;US)

AMERICIUM 241
Uses
Americium-241: the most useful isotope of the actinide elements, 10:10957 (R;US)

AMINO ALCOHOLS
See ALCOHOLS

AMNION CELLS
See EMBRYONIC CELLS

ANGIOGRAPHY
See BIOMEDICAL RADIOGRAPHY

ANHYDRIDES
Chemical Preparation
Simple molybdate selective oxidation catalysts containing excess MoO_3 for C_4 hydrocarbon oxidation to maleic anhydride, 10:11462 (R;US)
Synthesis
Biomass chemical production by thermochemical conversion, 10:11040 (J;US)

ANIMAL CELLS
Includes human cells.
See also CHO CELLS
EMBRYONIC CELLS
Biological Radiation Effects
Application of track calculations to radiobiology. III. Analysis of the molecular beam experiment results, 10:11677 (J;US)

Possible error-prone repair of neoplastic transformation induced by fission-spectrum neutrons, 10:11671 (R;US)

ANIMAL GROWTH
Inhibition
Pulmonary toxicity of inhaled coal liquid aerosols (boiling range 230-450°C), 10:10933 (J;US)

ANIMALS
Behavior
Public participation in studies of animal behavior prior to earthquakes: some cautionary remarks, 10:11716 (RA;US)

ANL
Accelerator Facilities
Radiological safety at Argonne National Laboratory's heavy ion research facility, 10:11542 (R;US)

ANODES
Materials Testing
Development of molten carbonate fuel cell power plant technology. Quarterly technical progress report No. 19, April 1-June 30, 1984, 10:11273 (R;US)
Poisoning
Carbon monoxide tolerant anodes and freeze resistant electrodes, 10:11259 (RA;US)

ANOMALONS
Looking for anomalons with a segmented Cerenkov detector, 10:11871 (R;US)

ANTENNAS
Performance
Surface wave excitation study, 10:11521 (R;US)

ANTIGENS
Identification Systems
Antigenic fingerprinting of methanogenic bacteria with polyclonal antibody probes, 10:11662 (J;DE)

ANTIMONY
Magnetization
Magnetization density of 5f electrons in ferromagnetic PuSb, 10:11361 (J;US)

ANTIREFLECTION COATINGS
Chemical Preparation
Scaling up the neutral solution antireflection process, 10:11423 (J;US)
Physical Radiation Effects
Scaling up the neutral solution antireflection process, 10:11423 (J;US)

AORTA
Biomedical Radiography
Aortography following subdiaphragmal aortic biopsy. Evaluation of 94 aortographies for an analysis of biopsy techniques and filling conditions including the peripheral regions, 10:11651 (R;DE;In German)

APARTMENT BUILDINGS
Design
Dwelling with energy, 10:11297 (J;US)
Energy Conservation
Dwelling with energy, 10:11297 (J;US)

APIS MELLIFERA
See BEES

APPENDIX (VERMIFORM)
See LYMPHATIC SYSTEM

AQUATIC ECOSYSTEMS
See also WETLANDS
Computerized Simulation
Parameter constraints in a stream ecosystem model: incorporation of a priori information in Monte Carlo error analysis, 10:11634 (J;NL)
Management
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 2, Appendix A: aquatic habitats, 10:11192 (R;US)

AQUIFERS
Mapping
Ogallala Aquifer Mapping Program (Deaf Smith and Swisher counties), 10:10997 (R;US)

ARCTIC REGIONS
Cloud Cover
Variation of Arctic cloud cover in summer, 10:11586 (R;US)

ARGON
Atom-Atom Collisions
Laser induced fluorescence study of Xe($5p^56p$, $5p^56p'$, $5p^57p$, and $5p^56d$) states in Ne and Ar: Radiative lifetimes and collisional deactivation rate constants, 10:11792 (J;US)
Ion-Atom Collisions
Investigations of molecular orbitals with accel-decel beams, 10:11759 (R;US)
Nucleation
Quantum Monte Carlo study of the thermodynamic properties of argon clusters: The homogeneous nucleation of argon in argon vapor and "magic number" distributions in argon vapor, 10:11448 (J;US)
Photoionization
Photoionization study of HgAr, 10:11770 (J;US)
Vapor Condensation
Quantum Monte Carlo study of the thermodynamic properties of argon clusters: The homogeneous nucleation of argon in argon vapor and "magic number" distributions in argon vapor, 10:11448 (J;US)

ARGON 40 REACTIONS
Fission
Reaching the capacity of a composite nucleus for energy and spin containment, 10:11886 (J;US)
Spallation
Unusual behavior of projectile fragments formed in the bombardment of copper with relativistic Ar ions, 10:11873 (R;US)

ARGON IONS
Collisions
Large-angle positronium emission for Al(110), 10:11760 (R;US)

ARGONNE NATIONAL LABORATORY
See ANL

AROMATIC COMPOUNDS
See AROMATICS

AROMATICS
See also BENZENE
CONDENSED AROMATICS
PHENOLS
POLYCYCLIC AROMATIC HYDROCARBONS
Electron Transfer
Sensitization and quenching in the conversion of light energy into chemical energy. Final report, 10:11468 (R;US)
Excited States
Sensitization and quenching in the conversion of light energy into chemical energy. Final report, 10:11468 (R;US)
Photochemical Reactions
Sensitization and quenching in the conversion of light energy into chemical energy. Final report, 10:11468 (R;US)
Synthesis
Biomass chemical production by thermochemical conversion, 10:11040 (J;US)

ARRAY PROCESSORS
Architecture
Hardware description languages for systolic architectures, 10:12013 (R;US)

ARRHENIUS EQUATION
Numerical Solution
Vibrational control of systems with Arrhenius dynamics, 10:12023 (J;US)

ARTERIES
See also AORTA
Biomedical Radiography
Normal anatomy and aneurysms of middle cerebral artery. A morphological, neuroradiological and clinical study, 10:11649 (R;DE)

ARTIFICIAL INTELLIGENCE
Pattern Recognition
Bulletin of the Electrotechnical Laboratory, Volume 48, No. 7, July 1984, 10:11942 (R;JP;In Japanese)

ASDEX TOKAMAK
Plasma Diagnostics
Analysis of local transport in neutral-beam-heated L and H plasmas of ASDEX, 10:11933 (R;DE)

ASHES
See also FLY ASH

Activation Analysis
Lund clearance of neutron-activated Mount St. Helens volanic ash in the rat, 10:11688 (J;US)
Biological Effects
Lung changes in rats inhaling volcanic ash for one year, 10:11712 (J;US)
Temperature Effects
Comparative study of world blast furnace cokes: behaviour of ash components, 10:10856 (R;AU)
ASTRONAUTS
Radiation Effects
Human exposure in low Earth orbit, 10:11904 (R;US)
ASTROPHYSICS
Meetings
High energy transients in astrophysics , 10:11746 (B;US)
ATLANTIC OCEAN
See also SOUTH ATLANTIC BIGHT
Continental Shelf
Shelfbreak circulation, fronts and physical oceanography: east and west coast perspectives, 10:11730 (J;US)
ATMOSPHERIC CHEMISTRY
Tracer Techniques
Isotopic analysis of enriched/depleted SO_2 via low-resolution mass sectrometry, 10:11429 (R;US)
ATMOSPHERIC PRECIPITATIONS
Monitoring
MAP3S precipitation chemistry network: seventh periodic summary report, 1983 (MAP3S Network), 10:11594 (R;US)
Water Chemistry
MAP3S precipitation chemistry network: seventh periodic summary report, 1983 (MAP3S Network), 10:11594 (R;US)
ATOM COLLISIONS
See also ION-ATOM COLLISIONS
PHOTON-ATOM COLLISIONS
Energy Transfer
Energy transfer in the collision of an atom with a cold lattice, 10:11784 (J;US)
ATOMIC BOMBS
See NUCLEAR WEAPONS
ATOMIC ENERGY
See NUCLEAR ENERGY
ATOMIC EXPLOSIONS
See NUCLEAR EXPLOSIONS
ATOMIC MODELS
LCAO Method
Efficient solution of Poisson's equation in linear combination of atomic orbitals (LCAO) electronic structure calculations, 10:11785 (J;US)
ATOMIC PHYSICS
Use only for indexing articles of very broad coverage, such as annual reviews, text books, etc.
Fundamental Constants
Impact of atomic physics on fundamental constants. Final report, 10:11769 (R;US)
ATOMIC WEAPONS
See NUCLEAR WEAPONS
ATRIA
Attitudes
Windows, skylights, and atria: occupants' visual/subjective comparison, 10:11316 (R;US)
Design
Daylighting data for atrium design, 10:11291 (R;US)
ATWS
Anticipated transients without scram.
Pressurizers
Experimental investigation of the performance of pressurizer safety valves during single- and two-phase flow (ATWS). Final report, 10:11163 (R;DE;In German)
AURORAE
Cyclotron Resonance
Influence of magnetic shear on the collisional current driven ion cyclotron instability. Memorandum report October 1983-October 1984, 10:11747 (R;US)
AUSTRALIA
See also NEW SOUTH WALES
Industrial Plants
Overview study to identify the potential contribution of technologies to energy conservation in Australian industry, 10:11215 (R;AU)
AUTOMOBILE EFFICIENCY STANDARDS
See AUTOMOBILES
AUTOMOBILE INDUSTRY
See AUTOMOTIVE INDUSTRY
AUTOMOBILES
Air Pollution Control
Low mileage catalyst evaluation with a methanol-fueled Rabbit - second interim report. Technical report, 10:11319 (R;US)
AUTOMOTIVE INDUSTRY
Research Programs
Impact of electric cars on national energy consumption, 10:11302 (J;US)
AUTORADIOGRAPHS
See IMAGES
AVIATION FUELS
Sales
Petroleum Marketing Monthly, October 1984, 10:10941 (R;US)
AZIDES
For inorganic compounds only. For organic azides, use AZIDO COMPOUNDS.
Health Hazards
Lack of induction of single-strand breaks in mammalian cells by sodium azide and its proximal mutagen, 10:11698 (J;NL)
Mutagenesis
Lack of induction of single-strand breaks in mammalian cells by sodium azide and its proximal mutagen, 10:11698 (J;NL)

B

B MESONS
Lifetime
Improved b lifetime measurement from MAC, 10:11820 (R;US)
Weak Particle Decay
Recent results from PEP, 10:11821 (R;US)
B-1235 RESONANCES
Coherent Production
Primakoff production of the B^+ (1235) meson, 10:11831 (J;US)
Radiative Decay
Primakoff production of the B^+ (1235) meson, 10:11831 (J;US)
BACTERIOPHAGES
Photoreactivation
Inducible reactivation of bacteriophage T7 damaged by methyl methanesulfonate or UV light, 10:11689 (J;US)
BALLOONING INSTABILITY
Larmor Radius
Finite-Larmor-radius modification of the Mercier criterion, 10:11969 (J;AT)
BANKS
See COMMERCIAL BUILDINGS
BARIUM
Solvent Extraction
Investigations of ion-size-selective synergism in solvent extraction, 10:11433 (J;US)
BARIUM 133
Sorption
Influence of basalt/groundwater interactions on radionuclide migration, 10:10998 (R;US)
BARIUM COMPOUNDS
See also BARIUM OXIDES
Phase Transformations
Absolute minimum of Landau's thermodynamic potential, 10:11907 (J;US)
BARIUM OXIDES
Crystal Field
Neutron scattering investigation of magnetic excitations at high energy transfers, 10:11389 (R;US)
Magnetic Susceptibility
Neutron scattering investigation of magnetic excitations at high energy transfers, 10:11389 (R;US)

BARSTOW SOLAR PILOT PLANT
10-MW solar central receiver pilot plant at Barstow, California.
Performance Testing
10 MWe Solar Thermal Central Receiver Pilot Plant Mode 5: Charging Only acceptance test procedure 1150, 10:11049 (R;US)
Thermal Energy Storage Equipment
10 MWe Solar Thermal Central Receiver Pilot Plant Mode 5: Charging Only acceptance test procedure 1150, 10:11049 (R;US)
BASALT
Corrosive Effects
Test methods to predict long-term corrosion of container materials in repositories, 10:11345 (R;US)
Mechanical Properties
Deformation of granitic rocks at elevated temperatures and pressures. Interim report, 1 March-15 December 1984, 10:11724 (R;US)
Rock-Fluid Interactions
Influence of basalt/groundwater interactions on radionuclide migration, 10:10998 (R;US)
Sorptive Properties
Progress in evaluation of radionuclide geochemical information developed by DOE high-level nuclear waste repository site projects. Report for January-March 1984, 10:11001 (R;US)
BATES LINAC MIT
See MIT BATES LINAC
BATTERIES (ELECTRIC)
See ELECTRIC BATTERIES
BEAM DUMPS
Performance
Diagnostics for the NBETF actively cooled beamdump, 10:11977 (R;US)
BEAM STRIPPERS
Charge changing cross sections of relativistic uranium, 10:11551 (R;US)
BEAM-PLASMA SYSTEMS
Parametric Instabilities
Parametric decay of Langmuir waves in an electron beam-plasma system, 10:11971 (J;GB)
Plasma Waves
Parametric decay of Langmuir waves in an electron beam-plasma system, 10:11971 (J;GB)
BEAUTY PARTICLES
Semileptonic Decay
Inclusive electron production from heavy quarks in e^+e^- annihilation at 34.6 GeV center of mass energy, 10:11818 (R;DE)
BEES
Reproduction
Sampling honeybee colonies for brood production: a double sampling technique, 10:11670 (J;US)
Sampling
Sampling honeybee colonies for brood production: a double sampling technique, 10:11670 (J;US)
BELT CONVEYORS
Fire Hazards
Detection of fire hazards in belt conveyors in coal mines, 10:10905 (TG;GB)
BENTHOS
Ecology
Gastropod shells: a dynamic resource that helps shape benthic community structure (Calliactis tricolor; Pagurus pollicaris; Calappa flammea; Octopus joubini; Panulirus argus), 10:11630 (J;NL)
Population Dynamics
Gastropod shells: a dynamic resource that helps shape benthic community structure (Calliactis tricolor; Pagurus pollicaris; Calappa flammea; Octopus joubini; Panulirus argus), 10:11630 (J;NL)
BENZENE
Excitation
Multiphoton ionization and excitation of fluoranthene and benzene in solution, 10:11467 (R;US)
Fluorescence
Multiphoton ionization and excitation of fluoranthene and benzene in solution, 10:11467 (R;US)
Ionization
Multiphoton ionization and excitation of fluoranthene and benzene in solution, 10:11467 (R;US)
Pyrolysis
Identification and temporal behavior of radical intermediates formed during the combustion and pyrolysis of gaseous fuels: kinetic pathways to soot formation. Progress report, September 1, 1982-June 30, 1985, 10:11475 (R;US)
BENZOPYRENE
Dose-Response Relationships
Dosimetry of PAH skin carcinogenesis: covalent binding of benzo[a]pyrene to mouse epidermal DNA, 10:11706 (J;US)
Fluorescence Spectroscopy
Fluorescence-line-narrowed spectra of polycyclic aromatic carcinogen-DNA adducts, 10:11642 (J;US)
Metabolic Activation
Cell specific activation of benzo[a]pyrene by fibroblasts and hepatocytes (Rats), 10:11710 (J;US)
Dosimetry of PAH skin carcinogenesis: covalent binding of benzo[a]pyrene to mouse epidermal DNA, 10:11706 (J;US)
Mutagenesis
Cell specific activation of benzo[a]pyrene by fibroblasts and hepatocytes (Rats), 10:11710 (J;US)
BENZOPYRROLES
See INDOLES
BERKELEY BEVALAC
See BEVALAC
BERKELIUM
Magnetic Properties
Magnetism of the heavy 5f elements, 10:11378 (J;CH)
BERYLLIUM 7
Beta-Minus Decay
Proposed solar neutrino experiment using $^{81}Br(nu,e^-)^{81}Kr$, 10:11736 (R;US)
BERYLLIUM 9 TARGET
Helium 3 Reactions
Nuclear reaction n + ^3He -> ^1H + ^3H as proximity reaction, 10:11869 (R;DE;In German)
BERYLLIUM FLUORIDES
Defects
Computer simulations of rare earth sites in glass: experimental tests and applications to laser materials, 10:11413 (R;US)
Microstructure
Computer simulations of rare earth sites in glass: experimental tests and applications to laser materials, 10:11413 (R;US)
BETA BACKSCATTERING GAGES
See RADIOMETRIC GAGES
BETA BEAMS (ELECTRONS)
See ELECTRON BEAMS
BEVALAC
Performance
Thirty years at the forefront: a perspective on the Bevatron/Bevalac, 10:11549 (R;US)
Reviews
Experiments with heavy beams at the Berkeley Bevalac, 10:11533 (R;US)
BEVATRON
Beam Strippers
Charge changing cross sections of relativistic uranium, 10:11551 (R;US)
Ion Beams
Charge changing cross sections of relativistic uranium, 10:11551 (R;US)
Performance
Thirty years at the forefront: a perspective on the Bevatron/Bevalac, 10:11549 (R;US)
BINARY ALLOY SYSTEMS
Phase Diagrams
Prediction of solid + liquid equilibrium diagrams for binary mixtures forming solid solutions with an extremum, 10:11379 (J;US)
BINARY MIXTURES
Diffusion
H-Division materials physics quarterly report, April-June 1984, 10:11323 (R;US)

Phase Diagrams
Prediction of solid + liquid equilibrium diagrams for binary mixtures forming solid solutions with an extremum, 10:11379 (J;US)

BIOASSAY
Sensitivity
Characterization of chemical waste site contamination and its extent using bioassays, 10:11618 (R;US)

BIOGAS
See METHANE

BIOLOGICAL MODELS
Evaluation
Open-ended rat tracheal implant model: toxic effects of formaldehyde on the respiratory epithelium, 10:11699 (J;NL)

BIOLOGICAL RADIATION EFFECTS
Mathematical Models
Application of track calculations to radiobiology. III. Analysis of the molecular beam experiment results, 10:11677 (J;US)

BIOLOGICAL REACTORS
See BIOREACTORS

BIOLOGICAL TESTING
See BIOASSAY

BIOMASS
Energy Source Development
Biomass energy options for the American Territories of the Pacific, 10:11223 (R;US)
Gasification
Biomass chemical production by thermochemical conversion, 10:11040 (J;US)
Biomass gasification: principles and technology, 10:11019 (B;US)
Hydrogenation
Biomass chemical production by thermochemical conversion, 10:11040 (J;US)
Hydrolysis
D-xylose fermentation by fusarium oxysporum and other fungi, 10:11023 (R;FI)
Research Programs
Appropriate Technology Small Grants Program. Code case studies, 10:11222 (R;US)
Thermochemical Processes
Overview of DOE's biomass thermochemical conversion process, 10:11018 (R;US)

BIOMEDICAL RADIOGRAPHY
See also INDUSTRIAL RADIOGRAPHY.
Accuracy
Comparison of arthrography to clinical diagnostics for diagnosing meniscal lesions, 10:11656 (R;DE;In German)
Comparative Evaluations
Ultrasonic mammography. Value and meaning of the method in comparison to X-ray mammography, thermography, and fine needle biopsy, 10:11655 (R;DE;In German)
Risk Assessment
How dangerous are routine X-ray checkups, 10:11657 (R;DE;In German)

BIOPSY
Comparative Evaluations
Ultrasonic mammography. Value and meaning of the method in comparison to X-ray mammography, thermography, and fine needle biopsy, 10:11655 (R;DE;In German)

BIOREACTORS
Prior to March 1983 this concept was indexed to CHEMICAL REACTORS.
Testing
Crab waste methane digester. Final report, 10:11014 (R;US)

BIRDS
Behavior
Seasonal abundance and habitat use patterns of shorebirds at two sites in northern Alaska, 10:11640 (J;GB)
Biological Adaptation
How seabirds adapt to ocean processes, 10:11628 (J;US)
Populations
Seasonal abundance and habitat use patterns of shorebirds at two sites in northern Alaska, 10:11640 (J;GB)

BLANKETS (BREEDING)
See BREEDING BLANKETS

BLAST FURNACES
Operation
Comparative study of world blast furnace cokes: behaviour of ash components, 10:10856 (R;AU)

BLEOMYCIN
Biological Effects
Potentiating effects of oxygen in lungs damaged by methylcyclopentadienyl manganese tricarbonyl, cadmium chloride, oleic acid, and antitumor drugs, 10:11693 (J;US)

BNL
Radiation Monitoring
1983 environmental monitoring report, 10:11607 (R;US)

BODY WAVES P (SEISMIC)
See SEISMIC P WAVES

BOILING WATER COOLED AND MODERATED REACTO
See BWR TYPE REACTORS

BONE JOINTS
Biomedical Radiography
Comparison of arthrography to clinical diagnostics for diagnosing meniscal lesions, 10:11656 (R;DE;In German)

BONE MARROW CELLS
Biological Radiation Effects
Relative biological effectiveness measurements using murine lethality and survival of intestinal and hematopoietic stem cells after Fermilab neutrons compared to JANUS reactor neutrons and ^{60}Co gamma rays, 10:11681 (J;US)

BONES
See SKELETON

BORON COMPOUNDS
Chemical Vapor Deposition
Chemical vapour deposition coating of hard metals with special reference to boron and boron compounds, 10:11343 (R;GB)

BOROSILICATE GLASS
Fractures
Effects of radial temperature gradients on glass fracture in simulated high-level waste canisters, 10:10984 (R;US)
Hydrothermal Alteration
Hydrothermal waste package interactions with methane-containing basalt groundwater, 10:10983 (R;US)

BOROSILICATES
See BOROSILICATE GLASS

BOSON EXPANSION
Research Programs
Progress in research, November 1, 1983-October 31, 1984, 10:11887 (R;US)

BOSONIZATION
See BOSON EXPANSION

BOTTOM MESONS
See B MESONS

BOTTOM PARTICLES
See BEAUTY PARTICLES

BRACKISH WATER ECOSYSTEMS
See AQUATIC ECOSYSTEMS

BRAIN
Biomedical Radiography
Normal anatomy and aneurysms of middle cerebral artery. A morphological, neuroradiological and clinical study, 10:11649 (R;DE)

BRASS-ALPHA
Stress Corrosion
Correlation of acoustic and electrochemical noise in the stress-corrosion cracking of α-brass, 10:11377 (J;GB)

BRAZIL
Energy Conservation
Importance of energy efficiency in the developing countries, 10:11303 (RA;US)

BRAZING
Electric Furnaces
Standard operating procedure, gas atmosphere brazing facility/LAMPF Equipment Test Laboratory, 10:11485 (R;US)

BREASTS
See MAMMARY GLANDS

BREEDING BLANKETS
Thermonuclear Reactor Materials
Prospects for low activity aluminium structures, 10:12000 (BA;GB)
BREMSSTRAHLUNG (MAGNETIC)
See SYNCHROTRON RADIATION
BRICKS
Materials Testing
Improving the thermal conductivity and storage capacity of European type ceramic tile stoves using olivine, July 15, 1982-June 31, 1984, 10:11288 (R;US)
BROMINE
Electronic Structure
Ab initio effective core potentials for molecular calculations. Potentials for main group elements Na to Bi, 10:11779 (J;US)
BROMINE BROMIDES
See BROMINE
BROMINE IONS
Electronic Structure
Ab initio effective core potentials for molecular calculations. Potentials for main group elements Na to Bi, 10:11779 (J;US)
BROMODEOXYURIDINE
See BUDR
BROOKHAVEN NATIONAL LABORATORY
See BNL
BROWN COAL
Chemical Composition
Trace elements in brown coal and its combustion products, 10:10878 (R;AU)
Combustion
Aerodynamics of burner jets designed for brown coal fired boilers, 10:10929 (R;AU)
Formation of nitrogen oxides from the combustion of Yallourn brown coal, 10:10927 (R;AU)
Trace elements in brown coal and its combustion products, 10:10878 (R;AU)
Devolatilization
Devolatilisation of brown coal, 10:10859 (R;AU)
Pyrolysis
Formation of nitrogen oxides from the combustion of Yallourn brown coal, 10:10927 (R;AU)
Volatile Matter
Formation of nitrogen oxides from the combustion of Yallourn brown coal, 10:10927 (R;AU)
BSF REACTOR
See BSR-1 REACTOR
BSR-1 REACTOR
Reactor Operation
Bulk Shielding Facility quarterly report, April, May and June 1984, 10:11136 (R;US)
BUDR
Biological Effects
Excision repair of ultraviolet- and chemically-induced damage in the DNA of fibroblasts derived from two closely related species of marine fishes, 10:11701 (J;NL)
Relationship between sister-chromatid exchange and perturbations in DNA replication in mutant EM9 and normal CHO cells, 10:11646 (J;NL)
BUILDING (CONSTRUCTING)
See CONSTRUCTION
BUILDING (MANUFACTURING)
See FABRICATION
BUILDINGS
See also COMMERCIAL BUILDINGS
HOSPITALS
OFFICE BUILDINGS
RESIDENTIAL BUILDINGS
Computer Codes
DOE-2 Building Energy Analysis Program, 10:11290 (R;US)
Energy Analysis
DOE-2 Building Energy Analysis Program, 10:11290 (R;US)
Energy Conservation
Potential of building electricity systems for load reduction and load levelling, 10:11284 (RA;US)
Fuel Cells
Energy conservation by on-site fuel cells, 10:11232 (RA;US)
Power Demand
Potential of building electricity systems for load reduction and load levelling, 10:11284 (RA;US)
BULK SHIELDING REACTOR-1
See BSR-1 REACTOR
BUMPY TORI
See also ELMO BUMPY TORUS
Electric Fields
Development of a differential equation for the ambipolar electric field in a bumpy torus in the low collision frequency limit, 10:11987 (J;US)
BUNKER OILS
See RESIDUAL FUELS
BURSA OF FABRICIUS
See BIRDS
LYMPHATIC SYSTEM
BUTADIENE
Pyrolysis
Identification and temporal behavior of radical intermediates formed during the combustion and pyrolysis of gaseous fuels: kinetic pathways to soot formation. Progress report, September 1, 1982-June 30, 1985, 10:11475 (R;US)
BUTENES
Oxidation
Simple molybdate selective oxidation catalysts containing excess MoO_3 for C_4 hydrocarbon oxidation to maleic anhydride, 10:11462 (R;US)
BUTYLENES
See BUTENES
BWR TYPE REACTORS
See also GRAND GULF-1 REACTOR
PEACH BOTTOM-2 REACTOR
SHOREHAM REACTOR
Cesium
Significance of cesium in LMFBR and LWR safety analysis, 10:11164 (R;DE)
Containment Systems
Calculation of thermal mixing for the BWR Mark I cantainment pressure suppression pool, 10:11158 (R;US)
Fuel Assemblies
Methods for QC fuel assemblies, 10:11084 (RA;DE)
QA/QC for nuclear fuel fabrication at ASEA-Atom, Sweden, 10:11082 (RA;DE)
Fuel Cans
Statistical methods in the quality control of UO_2 pellets and Zircaloy cladding tubes for water-reactor fuel rods, 10:11081 (RA;DE)
Fuel Cycle
Environmental assessment: DOE program to improve uranium utilization in light water reactors, 10:11125 (R;US)
Fuel Elements
Economic consequences of QA and QC in fuel and fuel assembly production, 10:11078 (RA;DE)
Performance-related characteristics of water reactor fuel - an update, 10:11087 (RA;DE)
Practical experience in the application of quality control in water-reactor fuel fabrication, 10:11099 (R;DE)
Role of the governmental authority in LWR fuel fabrication QA activities in Brazil, 10:11080 (RA;DE)
Statistical evaluation of fuel and fuel assembly production, 10:11101 (RA;DE)
Technology and performance of water reactor fuel, 10:11079 (RA;DE)
Fuel Pellets
Statistical methods in the quality control of UO_2 pellets and Zircaloy cladding tubes for water-reactor fuel rods, 10:11081 (RA;DE)
Fuel Rods
Measurement of the inner pressure of a fuel rod and determination of the filling gas purity, 10:11086 (RA;DE)
Inspection
Proceedings: second seminar on countermeasures for pipe cracking in BWRs. Volume 2. Remedy development, 10:11077 (R;US)

Meetings
Proceedings: second seminar on countermeasures for pipe cracking in BWRs. Volume 2. Remedy development, 10:11077 (R;US)
Meltdown
Preliminary observation of large scale UO_2 melt-concrete interactions and sustained steel-concrete interaction with an overlying water pool, 10:11173 (R;US)
Mixed Oxide Fuels
Fabrication and quality control of mixed oxide LWR fuel with regard to homogeneity of fissile content, 10:11083 (RA;DE)
Nuclear Fuels
Chemical assay as an element of quality control of light water fuels, 10:11085 (RA;DE)
Statistical evaluation of fuel and fuel assembly production, 10:11101 (RA;DE)
Pressure Vessels
LWR Pressure Vessel Surveillance Dosimetry Improvement Program. Semiannual progress report, October 1983-March 1984. Volume 1, 10:11088 (R;US)
Primary Coolant Circuits
CSNI specialist meeting on leak-before-break in nuclear reactor piping: proceedings, 10:11167 (R;US)
Pumps
Estimating common cause failure rates for pumps in nuclear reactors, 10:11076 (R;US)
Radioactive Aerosols
Aerosol instrumentation for the Marviken aerosol transport tests, 10:11131 (J;GB)
Reactor Accidents
BEAGL-01: a computer code for calculating rapid LWR core transients. Volume 2. User's manual, 10:11160 (R;US)
RAMONA-3B, a code for BWR plant transients, 10:11138 (R;US)
RETRAN-02: a program for Transient Thermal-hydraulic Analysis of Complex Fluid Flow Systems. Volume 3. User's manual. Revision 2, 10:11174 (R;US)
RETRAN-02: a program for Transient Thermal-hydraulic Analysis of Complex Fluid Flow systems. Volume 2. Programmer's manual. Revision 2, 10:11175 (R;US)
Reactor Cooling Systems
Proceedings: second seminar on countermeasures for pipe cracking in BWRs. Volume 2. Remedy development, 10:11077 (R;US)
Reactor Safety
Reports of reactor safety research projects sponsored by the Federal Ministry for Research and Technology (BMFT), 10:11161 (R;DE;In German)
Significance of cesium in LMFBR and LWR safety analysis, 10:11164 (R;DE)
Reactor Stability
BWR stability monitoring using neutron noise, 10:11091 (R;US)
Transients
BEAGL-01: a computer code for calculating rapid LWR core transients. Volume 2. User's manual, 10:11160 (R;US)
RAMONA-3B, a code for BWR plant transients, 10:11138 (R;US)
RETRAN-02: a program for Transient Thermal-hydraulic Analysis of Complex Fluid Flow Systems. Volume 3. User's manual. Revision 2, 10:11174 (R;US)
RETRAN-02: a program for Transient Thermal-hydraulic Analysis of Complex Fluid Flow systems. Volume 2. Programmer's manual. Revision 2, 10:11175 (R;US)

C

CABLES (ELECTRIC)
See ELECTRIC CABLES
CADMIUM
Biological Effects
Response of the adrenergic system in the cadmium-induced hypertensive rat, 10:11707 (J;US)
Toxicity
Zinc effects on glutathione metabolism relationship to zinc-induced protection from alkylating agents, 10:11700 (J;GB)
CADMIUM CARBONATES
Decomposition
Thermal decomposition of cadmium and cobalt carbonates, 10:11457 (J;US)
CADMIUM CHLORIDES
Biological Effects
Potentiating effects of oxygen in lungs damaged by methylcyclopentadienyl manganese tricarbonyl, cadmium chloride, oleic acid, and antitumor drugs, 10:11693 (J;US)
CAES
See COMPRESSED AIR ENERGY STORAGE
CALCIUM
Solvent Extraction
Investigations of ion-size-selective synergism in solvent extraction, 10:11433 (J;US)
CALCIUM 40
Energy Levels
Pion inelastic scattering to giant resonances and low-lying collective states in ^{118}Sn and ^{40}Ca, 10:11878 (J;US)
CALCIUM 40 REACTIONS
Anomalons
Looking for anomalons with a segmented Cerenkov detector, 10:11871 (R;US)
Deep Inelastic Heavy Ion Reactions
Mean-field dynamics versus two-body collisions at intermediate energy heavy-ion reactions, 10:11890 (R;DE)
CALCIUM 40 TARGET
Calcium 40 Reactions
Mean-field dynamics versus two-body collisions at intermediate energy heavy-ion reactions, 10:11890 (R;DE)
Pion Minus Reactions
Pion inelastic scattering to giant resonances and low-lying collective states in ^{118}Sn and ^{40}Ca, 10:11878 (J;US)
Pion Plus Reactions
Pion inelastic scattering to giant resonances and low-lying collective states in ^{118}Sn and ^{40}Ca, 10:11878 (J;US)
CALCIUM CARBONATES
Decomposition
Consideration of the role of sintering in gas-solid interactions, 10:11456 (J;NL)
Porosity
Consideration of the role of sintering in gas-solid interactions, 10:11456 (J;NL)
Sintering
Consideration of the role of sintering in gas-solid interactions, 10:11456 (J;NL)
CALCIUM COMPOUNDS
See also CALCIUM CARBONATES
CALCIUM SILICATES
Gas Chromatography
Identification of lignosulfonic acid and humic acid by pyrolysis, gas chromatography and mass spectrometry (Py-GC-MS) (Salts of lignosulfonic acid), 10:11437 (TG;US)
Mass Spectroscopy
Identification of lignosulfonic acid and humic acid by pyrolysis, gas chromatography and mass spectrometry (Py-GC-MS) (Salts of lignosulfonic acid), 10:11437 (TG;US)
Pyrolysis
Identification of lignosulfonic acid and humic acid by pyrolysis, gas chromatography and mass spectrometry (Py-GC-MS) (Salts of lignosulfonic acid), 10:11437 (TG;US)
CALCIUM FLUORIDES
Density
Pre-eutectic densification in MgF_2-CaF_2, 10:11401 (J;IT)
CALCIUM IONS
Ion-Atom Collisions
Resonant electron transfer and excitation in two, three, and four electron sub20Casupq+ and sub23Vsupq+ ions colliding with helium, 10:11781 (J;US)
CALCIUM SILICATES
Dissolution
Coupled diffusion phenomena. Final report, 10:11392 (R;US)

CALIFORNIUM
Magnetic Properties
Magnetism of the heavy 5f elements, 10:11378 (J;CH)
CALORIMETERS
Gamma Detection
Tower structured scintillator-lead photon calorimeter using a novel fiber optics readout system, 10:11564 (R;DE)
CALORIMETERS (PARTICLE)
See SHOWER COUNTERS
CAMAC SYSTEM
Computer Application to Measurement And Control.
Cooling Systems
Circulating water cooling system for a Camac Crate, 10:11567 (R;US)
CANCER
See NEOPLASMS
CANINES
See DOGS
CANISTERS
See CONTAINERS
CANONICAL EQUATIONS
See DIFFERENTIAL EQUATIONS
CARBOHYDRATES
Nuclear Magnetic Resonance
Applications of NMR to the dynamics of carbohydrates; simplifying NMR spectra of proteins, 10:11641 (R;US)
CARBON
See also GRAPHITE
Corrosion
Carbon corrosion in hot phosphoric acid fuel cells, 10:11263 (RA;US)
Density
Effect of heat treatment temperature (HTT) on density, weight and volume of glass-like carbon (GC), 10:11425 (J;GB)
Electron Reactions
Medium energy physics. Technical progress report, 10:11545 (R;US)
Multi-Photon Processes
Photoelectron angular distributions from resonant multiphoton ionization of atomic carbon, 10:11771 (J;US)
Photoelectron Spectroscopy
Photoelectron angular distributions from resonant multiphoton ionization of atomic carbon, 10:11771 (J;US)
Photoionization
Photoelectron angular distributions from resonant multiphoton ionization of atomic carbon, 10:11771 (J;US)
Volume
Effect of heat treatment temperature (HTT) on density, weight and volume of glass-like carbon (GC), 10:11425 (J;GB)
Weight
Effect of heat treatment temperature (HTT) on density, weight and volume of glass-like carbon (GC), 10:11425 (J;GB)
CARBON 12 TARGET
Proton Reactions
Inclusive pion production in 330, 400, and 500 MeV proton-nucleus collisions, 10:11870 (J;US)
CARBON 13
Spin Echo
NMR study of the chemisorption bond of carbon monoxide on platinum, 10:11418 (J;US)
CARBON DIOXIDE
Absorption
LICADO process for super-clean coal. Quarterly report, October-December 1983, 10:10912 (R;US)
Viscosity
Viscosity of carbon-monoxide mixtures with four gases in the temperature range 25-200°C: supplement, 10:11465 (J;DE)
CARBON DIOXIDE INJECTION
Additives
Mobility control for CO_2 injection (support for field project). Fourteenth quarterly report including project status report, August 17-November 17, 1984, 10:10937 (R;US)
Bench-Scale Experiments
Contracts for field projects and supporting research on enhanced oil recovery. Progress Review No. 39, quarter ending June 30, 1984, 10:10935 (R;US)
Evaluation
Mobility control for CO_2 injection (support for field project). Fourteenth quarterly report including project status report, August 17-November 17, 1984, 10:10937 (R;US)
Field Tests
Contracts for field projects and supporting research on enhanced oil recovery. Progress Review No. 39, quarter ending June 30, 1984, 10:10935 (R;US)
Mobility control for CO_2 injection (support for field project). Fourteenth quarterly report including project status report, August 17-November 17, 1984, 10:10937 (R;US)
CARBON DIOXIDE LASERS
Frequency Control
Compact frequency-stable pulsed CO_2 laser, 10:11493 (R;GB)
Oscillators
Reinjection laser oscillator and method, 10:11505 (P;US)
Stability
Compact frequency-stable pulsed CO_2 laser, 10:11493 (R;GB)
CARBON MONOXIDE
Chemical Bonds
NMR study of the chemisorption bond of carbon monoxide on platinum, 10:11418 (J;US)
Corrosive Effects
Testing of refractories in co-containing coal gasification atmospheres. Final report, 10:10840 (R;US)
Viscosity
Viscosity of carbon-monoxide mixtures with four gases in the temperature range 25-200°C: supplement, 10:11465 (J;DE)
CARBON OXIDE SULFIDE
See CARBON OXYSULFIDE
CARBON OXYSULFIDE
Chemical Reactions
Chemistry of carbonyl sulfide, 10:11442 (RA;US)
Chemistry
Chemistry of carbonyl sulfide, 10:11442 (RA;US)
CARBON STEELS
See also STEEL-ASTM-A533-B
Corrosion Resistance
Corrosion resistance of metallic solar absorber materials in a range of heat transfer fluids. Final technical report, 10:11055 (R;US)
CARBON TETRACHLORIDE
Metabolism
Damage of the hepatic mixed functional oxygenase system by CCl_4. Significance of incorporation of C-14-Cl_4 metabolites in vivo, 10:11647 (R;DE)
Toxicity
Damage of the hepatic mixed functional oxygenase system by CCl_4. Significance of incorporation of C-14-Cl_4 metabolites in vivo, 10:11647 (R;DE)
CARBON TETRAFLUORIDE
Viscosity
Viscosity of carbon-monoxide mixtures with four gases in the temperature range 25-200°C: supplement, 10:11465 (J;DE)
CARBONYL SULFIDE
See CARBON OXYSULFIDE
CARIES
Diagnosis
Experiments for improving the roentgen imaging and thus the caries diagnosis in the approximal space of lateral teeth, 10:11648 (R;DE;In German)
CASKS
See also SPENT FUEL CASKS
Design
Oak Ridge National Laboratory shipping containers for radioactive materials, 10:11486 (R;US)
Specifications
Byproducts Utilization Program: Sewage Sludge Irradiation Project. Progress report, July-December 1983, 10:11009 (R;US)
CASTING
Energy Conservation
[Continuous casting process-prototype]. Final report, 10:11308 (R;US)

CATALYST SUPPORTS
Chemistry
Properties of lanthanide oxides as supports for transition metal catalysts. Progress report, May 1, 1984-April 30, 1985, 10:11441 (R;US)
Comparative Evaluations
Properties of lanthanide oxides as supports for transition metal catalysts. Progress report, May 1, 1984-April 30, 1985, 10:11441 (R;US)
Corrosion
Carbon corrosion in hot phosphoric acid fuel cells, 10:11263 (RA;US)
Structural Chemical Analysis
Characterization of supported metal catalysts by imaging, microdiffraction and microanalysis techniques, 10:11439 (R;US)
CATALYSTS
Low mileage catalyst evaluation with a methanol-fueled Rabbit - second interim report. Technical report, 10:11319 (R;US)
Chemical Composition
Coal liquefaction research. Quarterly report, April-June 1984, 10:10849 (R;US)
Chemical Preparation
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 1, October-December 1983, 10:11458 (R;US)
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 4, July-September 1984, 10:11459 (R;US)
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 3, April-June 1984, 10:11460 (R;US)
Properties of lanthanide oxides as supports for transition metal catalysts. Progress report, May 1, 1984-April 30, 1985, 10:11441 (R;US)
Simple molybdate selective oxidation catalysts containing excess MoO_3 for C_4 hydrocarbon oxidation to maleic anhydride, 10:11462 (R;US)
Deactivation
Coal liquefaction research. Quarterly report, April-June 1984, 10:10849 (R;US)
Particle Size
Characterization of supported metal catalysts by imaging, microdiffraction and microanalysis techniques, 10:11439 (R;US)
Performance Testing
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 1, October-December 1983, 10:11458 (R;US)
Coal liquefaction research. Quarterly report, April-June 1984, 10:10849 (R;US)
Regeneration
Regeneration of catalysts for use in continuous flow coal hydrogenation, 10:10847 (R;AU)
Specificity
Simple molybdate selective oxidation catalysts containing excess MoO_3 for C_4 hydrocarbon oxidation to maleic anhydride, 10:11462 (R;US)
Structural Chemical Analysis
Characterization of supported metal catalysts by imaging, microdiffraction and microanalysis techniques, 10:11439 (R;US)
Simple molybdate selective oxidation catalysts containing excess MoO_3 for C_4 hydrocarbon oxidation to maleic anhydride, 10:11462 (R;US)
CATHODES
Materials
Stable materials for molten carbonate fuel cell cathodes, 10:11237 (RA;US)
Materials Testing
Development of molten carbonate fuel cell power plant technology. Quarterly technical progress report No. 19, April 1-June 30, 1984, 10:11273 (R;US)
Molten carbonate fuel cell cathode materials study, 10:11278 (J;US)
Semiconductor Materials
Molten carbonate fuel cell cathode materials study, 10:11278 (J;US)
CAUSTIC FLOODING
Field Tests
Contracts for field projects and supporting research on enhanced oil recovery. Progress Review No. 39, quarter ending June 30, 1984, 10:10935 (R;US)
CAVITIES
Fluid Flow
Three-dimensional lid-driven cavity flow: experiment and simulation, 10:11506 (R;US)
CCD
See CHARGE-COUPLED DEVICES
CELL GROWTH (ANIMAL)
See ANIMAL CELLS
CELL KILLING
Radioinduction
Survival of mammary epithelial cells from virgin female BALB/c mice following in vivo gamma irradiation, 10:11680 (J;US)
CELL PROLIFERATION
Tracer Techniques
Autoradiographical in-vitro examination of the cell proliferation of persisting psoriatic plaques in preferred areas under therapy with ultraviolet light: Photochemotherapy (PUVA) and selective ultraviolet phototherapy (SUP), 10:11654 (R;DE;In German)
CELLS (ANIMAL)
See ANIMAL CELLS
CELLULOSE
Alkaline Hydrolysis
Formation of dimethylbenzenediol via acyloin condensation and a reduction-oxidation pathway, 10:11463 (R;US)
Enzymatic Hydrolysis
Enzymatic conversion of cellulosic materials to sugars and alcohol: the technology and its implications, 10:11022 (R;AT)
CENTRAL RECEIVERS
Particles
Solid particle receiver experiments: radiant heat test, 10:11059 (R;US)
Testing
Solid particle receiver experiments: radiant heat test, 10:11059 (R;US)
CERAMICS
Physical Radiation Effects
Self-radiation damage in actinide host phases of nuclear waste forms ($Ca_2Nd_8(SiO_4)_6O_2$; $Gd_2Ti_2O_7$; $CaZrTi_2O_7$), 10:10981 (R;US)
Sintering
Pre-eutectic densification in MgF_2-CaF_2, 10:11401 (J;IT)
CERIUM ALLOYS
Electric Conductivity
Kondo-lattice—mixed-valence resistance scaling in heavy-fermion $CeCu_6$ under pressure, 10:11359 (J;US)
Phase stability and magnetic properties of UAl_2 based pseudobinary spin fluctuation compounds, 10:11341 (R;US)
Magnetic Susceptibility
Phase stability and magnetic properties of UAl_2 based pseudobinary spin fluctuation compounds, 10:11341 (R;US)
Phase Stability
Phase stability and magnetic properties of UAl_2 based pseudobinary spin fluctuation compounds, 10:11341 (R;US)
Phase Transformations
Kondo-lattice—mixed-valence resistance scaling in heavy-fermion $CeCu_6$ under pressure, 10:11359 (J;US)
Specific Heat
Phase stability and magnetic properties of UAl_2 based pseudobinary spin fluctuation compounds, 10:11341 (R;US)
CERIUM BORIDES
Crystal Field
Neutron scattering investigation of magnetic excitations at high energy transfers, 10:11389 (R;US)

Magnetic Susceptibility
Neutron scattering investigation of magnetic excitations at high energy transfers, 10:11389 (R;US)
CERIUM OXIDES
Binding Energy
Properties of lanthanide oxides as supports for transition metal catalysts. Progress report, May 1, 1984-April 30, 1985, 10:11441 (R;US)
CESIUM
Adsorption
Characterization of soils at proposed Solid Waste Storage Area (SWSA) 7, 10:11625 (R;US)
Solvent Extraction
Investigations of ion-size-selective synergism in solvent extraction, 10:11433 (J;US)
CESIUM 135
Mass Spectroscopy
Review of applications of mass spectrometry to low level radionuclide metrology, 10:11431 (J;NL)
Radiation Monitoring
Review of applications of mass spectrometry to low level radionuclide metrology, 10:11431 (J;NL)
CESIUM 137
Encapsulation
Byproducts Utilization Program: Sewage Sludge Irradiation Project. Progress report, July-December 1983, 10:11009 (R;US)
Ion Exchange
Studies of cation exchange for the isolation and concentration of trace level components of complex aqueous mixtures, 10:10974 (R;US)
Sorption
Influence of basalt/groundwater interactions on radionuclide migration, 10:10998 (R;US)
Uptake
Relationship between burial depth and radiocesium and radiostrontium and their accumulation in crop plants, 10:11621 (R;US)
CHARGE-COUPLED DEVICES
Readout Systems
Fast readout of CCD images, 10:11517 (R;US)
CHARGED PARTICLES
In addition to the specific charged particles listed below, see also the list under ELEMENTARY PARTICLES.
See also ALPHA PARTICLES
DEUTERONS
IONS
Neutrons and charged particles in radiotherapy. Oncology overview, 10:11659 (R;US)
CHARGED-PARTICLE ACTIVATION
See CHARGED PARTICLES
CHARGED-PARTICLE TRANSPORT
Computer Codes
UPEML: a machine-portable CDC Update emulator, 10:11902 (R;US)
CHARM PARTICLES
See also D MESONS
Semileptonic Decay
Inclusive electron production from heavy quarks in e^+e^- annihilation at 34.6 GeV center of mass energy, 10:11818 (R;DE)
CHARPAK CHAMBERS
See MULTIWIRE PROPORTIONAL CHAMBERS
CHARS
Combustion
Synthetic chars for studies of char combustion mechanism. Quarterly technical progress report, September 1-December 1, 1984, 10:10925 (R;US)
CHATTANOOGA FORMATION
Fluorescence Spectroscopy
Application of scanning electron microscopy and ultraviolet fluorescence to a study of Chattanooga shale specimens, 10:11616 (J;US)
Qualitative Chemical Analysis
Application of scanning electron microscopy and ultraviolet fluorescence to a study of Chattanooga shale specimens, 10:11616 (J;US)
Scanning Electron Microscopy
Application of scanning electron microscopy and ultraviolet fluorescence to a study of Chattanooga shale specimens, 10:11616 (J;US)
CHEMICAL EFFLUENTS
Monitoring
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 5, Appendix E: environmental monitoring, 10:11195 (R;US)
CHEMICAL EXPLOSIVES
See also TATB
Combustion Kinetics
Burning topology in the shock-induced reaction of heterogeneous explosives, 10:11584 (BA;US)
Detonations
Model for high rate gas flows in deformable and reactive porous beds, 10:11582 (R;US)
Performance Testing
Devonian production needs stimulation, 10:10952 (J;ZZ)
Technology Assessment
Devonian production needs stimulation, 10:10952 (J;ZZ)
CHEMICAL INDUSTRY
Fuel Cells
Development of fuel cell technology for industrial applications, 10:11252 (RA;US)
Fuel cells for chlor-alkali plants, 10:11251 (RA;US)
Hydrogen Fuel Cells
OXY hydrogen-air fuel cell, 10:11254 (RA;US)
CHEMICAL LASERS
Dissociation
Visible and near-infrared dissociation lasers. Final report 21 January 1982-20 April 1984, 10:11494 (R;US)
CHEMICAL RADIATION DETECTORS
Performance
Chlorine solar neutrino experiment, 10:11735 (R;US)
CHEMICAL REACTION KINETICS
Diffusion
Dynamical corrections to transition state theory for multistate systems: Surface self-diffusion in the rare-event regime, 10:11446 (J;US)
Flow Models
Block-implicit multigrid solution of Navier-Stokes equations in primitive variables, 10:11803 (R;US)
Sudden Approximation
Harmonic tunneling corrections to sudden and adiabatic transition state theory, 10:11776 (J;US)
CHEMICAL REACTORS
Design
Role of pilot plants in the development of U-Gas commercial reactor design, 10:10829 (R;US)
Flow Models
Existing technology transfer report dissolver cold-flow modelling, 10:10836 (R;US)
Glow Discharges
Research and development for advanced combined NO/sub x//SO_2 removal systems. Technical progress report No. 15, October 29, 1984-November 30, 1984, 10:10869 (R;US)
Multiphase Flow
Existing technology transfer report dissolver cold-flow modelling, 10:10836 (R;US)
Parametric Analysis
Research and development for advanced combined NO/sub x//SO_2 removal systems. Technical progress report No. 15, October 29, 1984-November 30, 1984, 10:10869 (R;US)
Stabilization
Vibrational control of systems with Arrhenius dynamics, 10:12023 (J;US)
CHEMICALS
See SURFACTANTS
CHEMISTRY
See also ATMOSPHERIC CHEMISTRY
Research Programs
RLE Progress Report No. 126, 10:11732 (R;US)
CHERENKOV COUNTERS
Looking for anomalons with a segmented Cerenkov detector, 10:11871 (R;US)

Design
Cerenkov ring imaging detector development for SLD, 10:11570 (R;US)

CHERENKOV DETECTORS
See CHERENKOV COUNTERS

CHINESE HAMSTER OVARY CELLS
See CHO CELLS

CHLOR-ALKALI INDUSTRY
See CHEMICAL INDUSTRY
CHLORINE
SODIUM HYDROXIDES

CHLORELLA
Metabolism
Ammonia regulation of intermediary metabolism in photosynthesizing and respiring Chlorella pyrenoidosa: comparative effects of methylamine, 10:11695 (J;JP)

CHLORINE
Electronic Structure
Ab initio effective core potentials for molecular calculations. Potentials for main group elements Na to Bi, 10:11779 (J;US)
Oscillator Strengths
H-Division materials physics quarterly report, April-June 1984, 10:11323 (R;US)
Production
Fuel cells for chlor-alkali plants, 10:11251 (RA;US)

CHLORINE CHLORIDES
See CHLORINE

CHLORINE IONS
Collisions
Effect of the chemical environment on the L and M heavy-ion-induced x-ray satellite emission spectra, 10:11762 (R;US)
Ultrahigh-resolution studies of heavy-ion-induced x-ray satellite emission, 10:11763 (R;US)
Electronic Structure
Ab initio effective core potentials for molecular calculations. Potentials for main group elements Na to Bi, 10:11779 (J;US)
Ion-Atom Collisions
Investigations of molecular orbitals with accel-decel beams, 10:11759 (R;US)

CHO CELLS
Cross-Linking
Lack of induction of single-strand breaks in mammalian cells by sodium azide and its proximal mutagen, 10:11698 (J;NL)
Sensitivity
Zinc effects on glutathione metabolism relationship to zinc-induced protection from alkylating agents, 10:11700 (J;GB)
Strand Breaks
Lack of induction of single-strand breaks in mammalian cells by sodium azide and its proximal mutagen, 10:11698 (J;NL)

CHROMIUM
Catalytic Effects
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 1, October-December 1983, 10:11458 (R;US)
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 3, April-June 1984, 10:11460 (R;US)
Sorptive Properties
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 4, July-September 1984, 10:11459 (R;US)

CHROMIUM ALLOYS
See also HASTELLOY N
STAINLESS STEELS
Oxidation
Isotope studies of Fe-18Cr-3Mo (100) oxidation using Raman spectroscopy, 10:11351 (R;US)

CHROMIUM OXIDES
Raman Spectra
Isotope studies of Fe-18Cr-3Mo (100) oxidation using Raman spectroscopy, 10:11351 (R;US)

CHROMIUM-MOLYBDENUM STEELS
See also ALLOY-HT-9
Creep
New series of advanced 3Cr-Mo-Ni steels for thick section pressure vessels in high temperature and pressure hydrogen service. Topical report, February 1, 1982-January 31, 1984, 10:11335 (R;US)
Microstructure
New series of advanced 3Cr-Mo-Ni steels for thick section pressure vessels in high temperature and pressure hydrogen service. Topical report, February 1, 1982-January 31, 1984, 10:11335 (R;US)
Modifications
New series of advanced 3Cr-Mo-Ni steels for thick section pressure vessels in high temperature and pressure hydrogen service. Topical report, February 1, 1982-January 31, 1984, 10:11335 (R;US)
Physical Radiation Effects
Charpy impact test results of ferritic alloys at fluence to 6 x 10^{22} n/cm , 10:11338 (R;US)
Tensile Properties
New series of advanced 3Cr-Mo-Ni steels for thick section pressure vessels in high temperature and pressure hydrogen service. Topical report, February 1, 1982-January 31, 1984, 10:11335 (R;US)
Yield Strength
New series of advanced 3Cr-Mo-Ni steels for thick section pressure vessels in high temperature and pressure hydrogen service. Topical report, February 1, 1982-January 31, 1984, 10:11335 (R;US)

CHROMIUM-NICKEL STEELS
See also STAINLESS STEEL-304
STAINLESS STEEL-316
STEEL-DIN-1-4981
Stress Corrosion
Incubation time and cracking pattern in transcrystalline stress corrosion of austenitic chromium-nickel steels in magnesium chloride solutions, 10:11386 (TJ;GB)

CHROMODYNAMICS
See QUANTUM CHROMODYNAMICS

CLADDING-FUEL INTERACTIONS
See FUEL-CLADDING INTERACTIONS

CLASSIFIED INFORMATION
CG-DAR-1: Guide to the declassified areas of nuclear energy research, 10:12024 (R;US)

CLAYS
Sorptive Properties
Geochemical information for sites contaminated with low-level radioactive wastes: II. St. Louis Airport Storage Site, 10:11003 (R;US)

CLIMATES
Mathematical Models
Efficient estimation of feedback effects with application to climate models, 10:11602 (J;US)

CLINTON P. ANDERSON MESON PHYSICS FACILIT
See LAMPF LINAC

CLOSED PLASMA DEVICES
See also HELIOTRON
TOKAMAK DEVICES
Magnet Coils
Fourier method for three-dimensional partial differential equations in periodic geometry. Application: HELIAC, 10:11985 (J;US)

CLOSTRIDIUM ACETOBUTYLICUM
Cultivation Techniques
New techniques for growing anaerobic bacteria: experiments with Clostridium butyricum and Clostridium acetobutylicum, 10:11663 (J;US)

CLOSTRIDIUM BUTYRICUM
Cultivation Techniques
New techniques for growing anaerobic bacteria: experiments with Clostridium butyricum and Clostridium acetobutylicum, 10:11663 (J;US)

CLOUDS
Limited to clouds in the earth atmosphere; for interstellar clouds see COSMIC DUST or COSMIC GASES.
Water Chemistry
OSCAR experiment high-density network data report: Event 4 - April 21-23, 1981, 10:11593 (R;US)

CLUSTERS (ION)
See ION PAIRS

CO2 FLOODING
See CARBON DIOXIDE INJECTION

COAL
See also BROWN COAL
SUBBITUMINOUS COAL
Ash Content
Bench scale development of the TRW process for cleaning coal (gravimelt process). Quarterly technical progress report, August-October 1984, 10:10842 (R;US)
Calorific Value
Use of fluidized bed coal combustion techniques to study efficiency, emission reduction, boiler effects, and waste utilization, 10:10922 (RA;US)
Carbonization
Carbonising properties of Australian coals and blends, 10:10846 (R;AU)
Chemical Analysis
Quantitative characterisation of mineral matter in a range of coals and coal generated materials, 10:10857 (R;AU)
Chemical Properties
Comparative study of world blast furnace cokes: behaviour of ash components, 10:10856 (R;AU)
Cleaning
LICADO process for super-clean coal. Quarterly report, October-December 1983, 10:10912 (R;US)
Combustion
Combustion and heat transfer in pulverised coal fired furnaces, 10:10928 (R;AU)
Combustion Products
Evaluation of particulate collection devices developed for pressurized fluidized-bed combustors as applied to coal gasification processes, 10:10867 (R;US)
Comminution
Ultrasonic vs mechanical comminution of coal II, 10:10906 (RA;US)
Depolymerization
Reduction of coal in solvated electron solutions, 10:10852 (RA;US)
Desulfurization
Extraction and desulfurization of chemically degraded coal with supercritical fluids, 10:10832 (RA;US)
Removal of organic sulfur from microbial coal (bacterial degradation of sulfur containing heterocyclic compounds), 10:10834 (RA;US)
Study of desulfurization by high-temperature leaching with chemical addition, 10:10833 (RA;US)
Electrochemistry
Electrochemistry of carbonaceous materials and coal, 10:11279 (J;US)
Flotation
Coal cleaning by froth flotation, 10:10913 (R;US)
Fluidized-Bed Combustion
Evaluation of particulate collection devices developed for pressurized fluidized-bed combustors as applied to coal gasification processes, 10:10867 (R;US)
Use of fluidized bed coal combustion techniques to study efficiency, emission reduction, boiler effects, and waste utilization, 10:10922 (RA;US)
Fragmentation
Mining research and development program. Second quarterly report, June 25, 1982-September 25, 1982, 10:10894 (R;US)
Fuel Feeding Systems
Coal firing of the Sirosmelt reactors, 10:10926 (R;AU)
Leaching
Study of desulfurization by high-temperature leaching with chemical addition, 10:10833 (RA;US)
Macerals
Separation and fluorescence characterization of coal macerals , 10:10851 (RA;US)
Market
Critical points in the coal fuel cycle: continued modeling analysis, 10:10931 (RA;US)
Mineralogy
Quantitative characterisation of mineral matter in a range of coals and coal generated materials, 10:10857 (R;AU)
Mixing
Carbonising properties of Australian coals and blends, 10:10846 (R;AU)
Molecular Structure
Reduction of coal in solvated electron solutions, 10:10852 (RA;US)
Nuclear Magnetic Resonance
NMR studies of fossil fuels. Final technical report, 10:10853 (R;US)
Particle Size
Coal cleaning by froth flotation, 10:10913 (R;US)
LICADO process for super-clean coal. Quarterly report, October-December 1983, 10:10912 (R;US)
Petrography
Applied coal and coke petrography, 10:10860 (R;AU)
Physical Properties
Comparative study of world blast furnace cokes: behaviour of ash components, 10:10856 (R;AU)
Pneumatic Transport
Dense phase pneumatic conveying of pulverised coal, 10:10918 (R;AU)
Production
Quarterly coal report, July-September 1984, 10:10930 (R;US)
Rail Transport
Rail coal transportation under the Staggers Act, 10:11214 (R;US)
Reduction
Reduction of coal in solvated electron solutions, 10:10852 (RA;US)
Research Programs
High-sulfur coal research at the SIUC Coal Technology Center. Quarterly report, July 1-September 30, 1984, 10:10831 (R;US)
Sampling
Size classification of Illinois basin coals for desulfurization by froth flotation, 10:10908 (RA;US)
Sorptive Properties
LICADO process for super-clean coal. Quarterly report, October-December 1983, 10:10912 (R;US)
Standardized Terminology
Terminology of the characteristics of fuel peat and coal, 10:10854 (R;FI;In Finnish, English, and German)
Structural Chemical Analysis
Coal characteristics and their role in hydrogenation, 10:10858 (R;AU)
Sulfur Content
Bench scale development of the TRW process for cleaning coal (gravimelt process). Quarterly technical progress report, August-October 1984, 10:10842 (R;US)
High-sulfur coal research at the SIUC Coal Technology Center. Quarterly report, July 1-September 30, 1984, 10:10831 (R;US)
Supercritical Gas Extraction
Extraction and desulfurization of chemically degraded coal with supercritical fluids, 10:10832 (RA;US)
Testing
Carbonising properties of Australian coals and blends, 10:10846 (R;AU)
Transport
Disaggregating regional energy supply/demand and flow data to 173 BEAs in support of the national energy transportation study. Final report (In USA by pipeline, rail, truck and barge; potential bottlenecks between 1955 to 1995), 10:11210 (R;US)
X-Ray Diffraction
Examination of the mineral components of coal and its resultant fly ash in relation to resistivity characteristics of the fly ash, 10:10855 (R;AU)
X-Ray Fluorescence Analysis
Examination of the mineral components of coal and its resultant fly ash in relation to resistivity characteristics of the fly ash, 10:10855 (R;AU)
COAL DEPOSITS
See also COAL SEAMS
Exploration
Computer modelling of coal basins, 10:10891 (R;AU)
Mathematical Models
Computer modelling of coal basins, 10:10891 (R;AU)

Origin
Facies modelling and palaeoenvironmental reconstruction of coal measures sedimentation within several Queensland coal basins, 10:10892 (R;AU)

COAL FINES
Agglomeration
Oil agglomeration: fundamental studies, 10:10914 (R;AU)
Combustion
Fine particle coal as a source of energy in small user applications, 10:10923 (RA;US)
Combustion Properties
Fine particle coal as a source of energy in small user applications, 10:10923 (RA;US)
Desulfurization
Size classification of Illinois basin coals for desulfurization by froth flotation, 10:10908 (RA;US)
Flotation
Improved recovery of fine coal, 10:10916 (R;AU)
Preparation of super-clean coal. Technical progress report for third and fourth quarters, March 15, 1984-September 14, 1984, 10:10911 (R;US)
Hydraulic Transport
Hydrocylcone system for recovery of low-sulfur coal fines from gob, 10:10907 (RA;US)
Recovery
Coal washery reject disposal, 10:10915 (R;AU)
Hydrocylcone system for recovery of low-sulfur coal fines from gob, 10:10907 (RA;US)
Improved recovery of fine coal, 10:10916 (R;AU)
Oil agglomeration: fundamental studies, 10:10914 (R;AU)

COAL FUEL CELLS
Electrochemistry
Electrochemistry of carbonaceous materials and coal, 10:11279 (J;US)

COAL GAS
Mutagenesis
Cytotoxicity and mutagenicity of vapor-phase pollutants in rat lung epithelial cells and Chinese hamster ovary cells grown on collagen gels, 10:11697 (J;US)
Toxicity
Cytotoxicity and mutagenicity of vapor-phase pollutants in rat lung epithelial cells and Chinese hamster ovary cells grown on collagen gels, 10:11697 (J;US)

COAL GASIFICATION PLANTS
Chemical Composition
New series of advanced 3Cr-Mo-Ni steels for thick section pressure vessels in high temperature and pressure hydrogen service. Topical report, February 1, 1982-January 31, 1984, 10:11335 (R;US)
Materials
Surface Gasification Materials Program. Semiannual progress report for the period ending September 30, 1984, 10:10848 (R;US)
Materials Testing
Testing of refractories in co-containing coal gasification atmospheres. Final report, 10:10840 (R;US)
Pressure Vessels
New series of advanced 3Cr-Mo-Ni steels for thick section pressure vessels in high temperature and pressure hydrogen service. Topical report, February 1, 1982-January 31, 1984, 10:11335 (R;US)
Refractories
Testing of refractories in co-containing coal gasification atmospheres. Final report, 10:10840 (R;US)

COAL INDUSTRY
Data Compilation
Quarterly coal report, July-September 1984, 10:10930 (R;US)

COAL LIQUEFACTION
See also EXXON LIQUEFACTION PROCESS
TSL PROCESS
Catalysts
Coal liquefaction research. Quarterly report, April-June 1984, 10:10849 (R;US)
Information Systems
Interview write-ups supporting the feasibility analysis for data base design, 10:10841 (R;US)
Research Programs
Coal liquefaction research. Quarterly report, April-June 1984, 10:10849 (R;US)
Technology Assessment
Coal liquefaction research. Quarterly report, April-June 1984, 10:10849 (R;US)

COAL LIQUEFACTION PLANTS
Pressure Vessels
New series of advanced 3Cr-Mo-Ni steels for thick section pressure vessels in high temperature and pressure hydrogen service. Topical report, February 1, 1982-January 31, 1984, 10:11335 (R;US)
Process Solutions
Integrated analytical approach to detailed chemical characterization of coal liquefaction process materials, 10:10861 (R;US)
Residues
Gasification of residual materials from coal liquefaction. Final report, 10:10830 (R;US)

COAL LIQUIDS
Biological Effects
Effects of chronic exposure to coal-derived oil on freshwater ecosystems. I. Microcosms, 10:10886 (J;US)
Effects of chronic exposure to coal-derived oil on freshwater ecosystems. II. Experimental ponds, 10:10887 (J;US)
Chemical Composition
Process-related effects on chemical composition of direct coal liquefaction materials, 10:10862 (R;US)
Combustion Properties
Combustion characteristics of synthetic liquid fuels. Quarterly technical progress report,January 1-March 31, 1982, 10:11013 (R;US)
Fractionation
Identification of polycyclic aromatic compounds containing two heteroatoms in coal liquids and shale oils. Incremental funding request and annual progress report, December 1, 1983-November 31, 1984, 10:10850 (R;US)
Hydrogenation
Regeneration of catalysts for use in continuous flow coal hydrogenation, 10:10847 (R;AU)
Process Solutions
Integrated analytical approach to detailed chemical characterization of coal liquefaction process materials, 10:10861 (R;US)
Toxicity
Pulmonary toxicity of inhaled coal liquid aerosols (boiling range 230-450°C), 10:10933 (J;US)
Survival, respiration, and food assimilation of Daphnia magna exposed to petroleum- and coal-derived oils at three temperatures, 10:11704 (J;CA)

COAL MINERS
Transport
Safety regulations for coal and oil shale mines, Moscow - 1973, Chapter IV: Road haulage and shaft winding. 2. Manriding and transport of persons and material in level workings , 10:10919 (TG;GB)

COAL MINES
Environmental Impacts
Evaluation of existing data on discharges from active coal mines in Illinois, 10:10884 (RA;US)
Water Pollution
Evaluation of existing data on discharges from active coal mines in Illinois, 10:10884 (RA;US)

COAL MINING
Acid Mine Drainage
Effects of coal mining on ground-water quality in West Virginia, 10:10882 (RA;US)
Economic Impact
Planning framework for the accommodation for coal development by Wollongong City, 10:10932 (R;AU)
Land Reclamation
Economic effects of subsidence from underground coal mining on agricultural land in Illinois. Open file report, 1 September 1982-30 November 1984, 10:10879 (R;US)

Planning
Planning framework for the accommodation for coal development by Wollongong City, 10:10932 (R;AU)
Spoil Banks
Vegetative response to topsoil versus alternative growth materials in a four-year old study in Kentucky, 10:10874 (RA;US)
COAL PREPARATION
Flotation
Coal cleaning by flotation, 10:10917 (R;AU)
Size classification of Illinois basin coals for desulfurization by froth flotation, 10:10908 (RA;US)
Process Control
Coal washery reject disposal, 10:10915 (R;AU)
COAL PREPARATION PLANTS
Water Resources
Simplified modeling of slurry impoundment effluent water quality, 10:10871 (RA;US)
COAL RESERVES
Resource Assessment
Computer modelling of coal basins, 10:10891 (R;AU)
COAL SEAMS
Degassing
Gas drainage by horizontal longhole drilling: field trials at Tahmoor Colliery, 10:10893 (R;AU)
Unconventional natural gas, 10:10949 (R;US)
Rock Mechanics
Geomechanical evaluation of alternative underground mining methods, 10:10899 (R;AU)
Seismic Surveys
In seam exploration in coal mines using vibration measurement, 10:10890 (R;AU)
COAL-DERIVED LIQUIDS
See COAL LIQUIDS
COAL-OIL MIXTURES
See COAL
FUEL OILS
FUEL SLURRIES
COASTAL WATERS
Birds
How seabirds adapt to ocean processes, 10:11628 (J;US)
Mass Transfer
Nearshore transport processes affecting the dilution and fate of energy-related contaminants. Progress report, June 1, 1981-November 30, 1984, 10:11729 (R;US)
Water Currents
Nearshore transport processes affecting the dilution and fate of energy-related contaminants. Progress report, June 1, 1981-November 30, 1984, 10:11729 (R;US)
COATINGS
See also ANTIREFLECTION COATINGS
Flexibility
H-Division materials physics quarterly report, April-June 1984, 10:11323 (R;US)
COBALT
Adsorption
Characterization of soils at proposed Solid Waste Storage Area (SWSA) 7, 10:11625 (R;US)
Binding Energy
Properties of lanthanide oxides as supports for transition metal catalysts. Progress report, May 1, 1984-April 30, 1985, 10:11441 (R;US)
Catalytic Effects
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 1, October-December 1983, 10:11458 (R;US)
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 4, July-September 1984, 10:11459 (R;US)
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 3, April-June 1984, 10:11460 (R;US)
Solvent Extraction
Kinetics and mechanism of the interfacial mass transfer of Zn^{2+}, Co^{2+} and Ni^{2+} in the system: bis(2-ethylhexyl)phosphoric acid, n-dodecane - KNO_3, water, 10:11434 (J;US)
Sorptive Properties
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 3, April-June 1984, 10:11460 (R;US)
Hydrogen chemisorption on transition metal clusters, 10:11449 (J;US)
Surface Properties
Properties of lanthanide oxides as supports for transition metal catalysts. Progress report, May 1, 1984-April 30, 1985, 10:11441 (R;US)
COBALT ALLOYS
Ductility
Ductile ordered intermetallic alloys, 10:11363 (J;US)
Fabrication
Ductile ordered intermetallic alloys, 10:11363 (J;US)
COBALT CARBONATES
Decomposition
Thermal decomposition of cadmium and cobalt carbonates, 10:11457 (J;US)
COBALT COMPLEXES
Chemical Reactions
Synthesis and reactivity of heterodinuclear iron, ruthenium, and cobalt compounds containing bridging dithiomethylene ligands. Attempted synthesis of the iron carbyne compound $Cp(CO)FeCSCH_3$, 10:11461 (R;US)
Structural Chemical Analysis
Synthesis and reactivity of heterodinuclear iron, ruthenium, and cobalt compounds containing bridging dithiomethylene ligands. Attempted synthesis of the iron carbyne compound $Cp(CO)FeCSCH_3$, 10:11461 (R;US)
Synthesis
Synthesis and reactivity of heterodinuclear iron, ruthenium, and cobalt compounds containing bridging dithiomethylene ligands. Attempted synthesis of the iron carbyne compound $Cp(CO)FeCSCH_3$, 10:11461 (R;US)
COBALT COMPOUNDS
See also COBALT CARBONATES
COBALT NITRATES
Catalytic Effects
Simple molybdate selective oxidation catalysts containing excess MoO_3 for C_4 hydrocarbon oxidation to maleic anhydride, 10:11462 (R;US)
COBALT NITRATES
Reduction
Properties of lanthanide oxides as supports for transition metal catalysts. Progress report, May 1, 1984-April 30, 1985, 10:11441 (R;US)
COGENERATION
Prior to November 1980, this concept was indexed to CO-GENERATION.
See COGENERATION
Fuel Cells
Barriers and incentives to commercialization of fuel cell technology in cogeneration applications. Final report, 10:11274 (R;US)
COGENERATION PLANTS
See DUAL-PURPOSE POWER PLANTS
COKE
Ashes
Comparative study of world blast furnace cokes: behaviour of ash components, 10:10856 (R;AU)
Chemical Properties
Comparative study of world blast furnace cokes: behaviour of ash components, 10:10856 (R;AU)
Chemical Reaction Kinetics
Carbonising properties of Australian coals and blends, 10:10846 (R;AU)
Mechanical Properties
Carbonising properties of Australian coals and blends, 10:10846 (R;AU)
Petrography
Applied coal and coke petrography, 10:10860 (R;AU)
Physical Properties
Comparative study of world blast furnace cokes: behaviour of ash components, 10:10856 (R;AU)

COKE OVENS
Operation
Comparative study of world blast furnace cokes: behaviour of ash components, 10:10856 (R;AU)
COKE-OVEN GAS
See COAL GAS
COLLECTIVE ACCELERATORS
Electric Fields
Space-charge wave propagation in inhomogeneous waveguides, 10:11535 (J;US)
COLLEGES
See EDUCATIONAL FACILITIES
COLLIERIES
See COAL MINES
COLOGNE SPIRITS
See ETHANOL
COLONY FORMATION
Biological Radiation Effects
New techniques for growing anaerobic bacteria: experiments with Clostridium butyricum and Clostridium acetobutylicum, 10:11663 (J;US)
COLUMBIUM
See NIOBIUM
COMBINED STEAM-POWER GENERATION
See COGENERATION
COMBUSTION
See also FLUIDIZED-BED COMBUSTION
Efficiency
Coal water mixture combustion in Multiannular Swirl Burner (MASB). Low Emission Combustor Technology Program. Draft, 10:10924 (R;US)
Research Programs
Synthetic chars for studies of char combustion mechanism. Quarterly technical progress report, September 1-December 1, 1984, 10:10925 (R;US)
COMBUSTION PRODUCTS
Chemical Composition
Trace elements in brown coal and its combustion products, 10:10878 (R;AU)
Hot Gas Cleanup
Evaluation of particulate collection devices developed for pressurized fluidized-bed combustors as applied to coal gasification processes, 10:10867 (R;US)
COMMERCIAL BUILDINGS
Design
168 proof?, 10:11295 (J;US)
Energy for sales, 10:11299 (J;US)
Energy Conservation
168 proof?, 10:11295 (J;US)
Energy for sales, 10:11299 (J;US)
Technological and economic issues in building energy use, 10:11285 (RA;US)
Energy Consumption
Technological and economic issues in building energy use, 10:11285 (RA;US)
COMMERCIAL SECTOR
Energy Conservation
Introduction and background, 10:11282 (RA;US)
COMMINUTION
Comparative Evaluations
Ultrasonic vs mechanical comminution of coal II, 10:10906 (RA;US)
COMPOSITE MATERIALS
Flexural Strength
Particulate toughened silicon carbide (SiC-TiC composites), 10:11404 (R;US)
Fracture Properties
Particulate toughened silicon carbide (SiC-TiC composites), 10:11404 (R;US)
Mechanical Properties
Theories of immiscible and structured mixtures, 10:11911 (J;GB)
COMPOUNDS (ORGANIC)
See ORGANIC COMPOUNDS
COMPRESSED AIR ENERGY STORAGE
Rock Mechanics
Stability criteria for storage of compressed air in hard rock reservoirs, 10:11176 (R;US)
Underground Storage
Stability criteria for storage of compressed air in hard rock reservoirs, 10:11176 (R;US)
COMPUTER CODES
Computer codes are indexed by their initial letter and CODES, e.g., A CODES. If the code name begins with a number the code is indexed to NUMBER CODES.
B Codes
BEAGL-01: a computer code for calculating rapid LWR core transients. Volume 2. User's manual, 10:11160 (R;US)
BEARING and BPLOT: two programs for designing full (360-degree) journal bearings, 10:11479 (R;US)
C Codes
Introduction to CHART: a graphic analysis and display system. Revision, 10:12015 (R;US)
Information Centers
Value of the National Energy Software Center and the Radiation Shielding Information Center. Volume 2, 10:12028 (RA;US)
K Codes
KENO-V code, 10:11119 (R;US)
M Codes
Model documentation for the mini-macroeconomic model: MINMAC, 10:11182 (R;US)
MORSE Monte Carlo code, 10:11120 (R;US)
User's and programmer's guide to the mechanics of Moving Finite Element code, 10:12018 (R;US)
P Codes
PLUVIUS: a generalized one-dimensional model of reactive pollutant behavior, including dry deposition, precipitation formation, and wet removal. Second edition, 10:11592 (R;US)
R Codes
RADTWO: a computer code for simulating fast-transient, two-dimensional, two-layer radionuclide concentration conditions in lakes, reservoirs, rivers, estuaries, and coastal regions, 10:11636 (R;US)
RETRAN-02: a program for Transient Thermal-hydraulic Analysis of Complex Fluid Flow Systems. Volume 3. User's manual. Revision 2, 10:11174 (R;US)
RETRAN-02: a program for Transient Thermal-hydraulic Analysis of Complex Fluid Flow systems. Volume 2. Programmer's manual. Revision 2, 10:11175 (R;US)
T Codes
User's guide for TWODANT: a code package for two-dimensional, diffusion-accelerated, neutral-particle transport. Revision 1, 10:11899 (R;US)
U Codes
UPEML: a machine-portable CDC Update emulator, 10:11902 (R;US)
COMPUTER GRAPHICS
Computer Codes
Introduction to CHART: a graphic analysis and display system. Revision, 10:12015 (R;US)
Programming
Research work in the state-of-the-art in computer graphics. Progress report, August 1, 1983-June 31, 1984, 10:12010 (R;US)
COMPUTER NETWORKS
Management
CLARET user's manual: Mainframe Logs. Revision 1, 10:12017 (R;US)
COMPUTER PROGRAMMING
See PROGRAMMING
COMPUTER PROGRAMS
See COMPUTER CODES
COMPUTER-AIDED DESIGN
Computer Codes
BEARING and BPLOT: two programs for designing full (360-degree) journal bearings, 10:11479 (R;US)
COMPUTERIZED CONTROL SYSTEMS
Analog Computers
Performance report for Stanford/SLAC Microstore Analog Memory Unit, 10:11552 (R;US)

Reliability
Contribution of instrumentation and control software to system reliability, 10:12012 (R;US)
COMPUTERS
See also DIGITAL COMPUTERS
Architecture
Future database machine architectures, 10:12007 (R;US)
CONCENTRATING COLLECTORS
Comparative Evaluations
Comparison of concentrating collectors to tracking flat panels, 10:11029 (RA;US)
Cost
Comparison of concentrating collectors to tracking flat panels, 10:11029 (RA;US)
CONDENSED AROMATICS
See also BENZOPYRENE
NAPHTHALENE
PYRENE
Excitation
Multiphoton ionization and excitation of fluoranthene and benzene in solution, 10:11467 (R;US)
Fluorescence
Multiphoton ionization and excitation of fluoranthene and benzene in solution, 10:11467 (R;US)
Ionization
Multiphoton ionization and excitation of fluoranthene and benzene in solution, 10:11467 (R;US)
CONDUCTIVITY (THERMAL)
See THERMAL CONDUCTIVITY
CONSERVATION (ENERGY)
See ENERGY CONSERVATION
CONSTRUCTION
Planning
Schedule planning for construction projects, 10:12004 (R;US)
CONTACT RADIOTHERAPY
See RADIOTHERAPY
CONTAINERS
See also CASKS
PRESSURE VESSELS
REACTOR VESSELS
TANKS
Corrosion
Test methods to predict long-term corrosion of container materials in repositories, 10:11345 (R;US)
Design
Oak Ridge National Laboratory shipping containers for radioactive materials, 10:11486 (R;US)
Temperature Gradients
Effects of radial temperature gradients on glass fracture in simulated high-level waste canisters, 10:10984 (R;US)
CONTAINMENT SYSTEMS
Hydraulics
Calculation of thermal mixing for the BWR Mark I cantainment pressure suppression pool, 10:11158 (R;US)
Mixing
Calculation of thermal mixing for the BWR Mark I cantainment pressure suppression pool, 10:11158 (R;US)
Pressure Suppression
Calculation of thermal mixing for the BWR Mark I cantainment pressure suppression pool, 10:11158 (R;US)
CONTINENTAL SHELF
Natural Gas Deposits
Proposed Gulf of Alaska/Cook Inlet lease sale 88. Final environmental impact statement. Volume 1, 10:10943 (R;US)
Proposed Gulf of Alaska/Cook Inlet lease sale 88. Final environmental impact statement. Volume 2. Appendices, 10:10944 (R;US)
Oceanography
Shelfbreak circulation, fronts and physical oceanography: east and west coast perspectives, 10:11730 (J;US)
Petroleum Deposits
Proposed Gulf of Alaska/Cook Inlet lease sale 88. Final environmental impact statement. Volume 1, 10:10943 (R;US)
Proposed Gulf of Alaska/Cook Inlet lease sale 88. Final environmental impact statement. Volume 2. Appendices, 10:10944 (R;US)
Sediments
Shelfbreak circulation, fronts and physical oceanography: east and west coast perspectives, 10:11730 (J;US)
Water Currents
Effects of alongshore variation in bottom topography on a boundary current (topographically induced upwelling), 10:11731 (J;GB)
CONTROL THEORY (REACTOR)
See REACTOR KINETICS
COOK INLET
See GULF OF ALASKA
COOLANT CLEANUP SYSTEMS
Activity Levels
Simulation calculations for a catalytic exchange/cryogenic distillation hydrogen isotope separation process, 10:11137 (R;US)
Water Chemistry
Simulation calculations for a catalytic exchange/cryogenic distillation hydrogen isotope separation process, 10:11137 (R;US)
COOLERS
See HEAT EXCHANGERS
COOLING SYSTEM (REACTOR)
See REACTOR COOLING SYSTEMS
COOLING SYSTEMS
See also REACTOR COOLING SYSTEMS
Hydrodynamics
Application of zone-matching methodology to interacting submerged multiport diffusers, 10:11123 (R;US)
Pumps
Primary coolant pump measurement for ICC trend analysis, 10:11093 (R;US)
COOLING TOWERS
Inspection
Cooling tower wood sampling analyses: a case study, 10:11484 (R;US)
Materials
Cooling tower wood sampling analyses: a case study, 10:11484 (R;US)
COPPER
Adhesion
H-Division materials physics quarterly report, April-June 1984, 10:11323 (R;US)
Argon 40 Reactions
Unusual behavior of projectile fragments formed in the bombardment of copper with relativistic Ar ions, 10:11873 (R;US)
Biological Availability
Metal regulation and toxicity in aquatic organisms, 10:11703 (BA;US)
Ductility
Mechanical properties of electrodeposited nickel and copper, 10:11348 (R;US)
Electrodeposition
Mechanical properties of electrodeposited nickel and copper, 10:11348 (R;US)
Electronic Structure
Nuclear-magnetic-resonance study of electronic structure in the copper-niobium superlattice, 10:11356 (J;US)
Metabolism
Metal regulation and toxicity in aquatic organisms, 10:11703 (BA;US)
Nuclear Magnetic Resonance
Nuclear-magnetic-resonance study of electronic structure in the copper-niobium superlattice, 10:11356 (J;US)
Sorptive Properties
Hydrogen chemisorption on transition metal clusters, 10:11449 (J;US)
Tensile Properties
Mechanical properties of electrodeposited nickel and copper, 10:11348 (R;US)
Thickness
Mechanical properties of electrodeposited nickel and copper, 10:11348 (R;US)
Toxicity
Metal regulation and toxicity in aquatic organisms, 10:11703 (BA;US)

COPPER ALLOYS
Corrosion Resistance
Corrosion resistance of metallic solar absorber materials in a range of heat transfer fluids. Final technical report, 10:11055 (R;US)
Electric Conductivity
Kondo-lattice—mixed-valence resistance scaling in heavy-fermion $CeCu_6$ under pressure, 10:11359 (J;US)
Electronic Structure
First principles theory of Fermi-surface driven concentration waves in Cu/sub c/Pd/sub 1-c/ alloys, 10:11328 (R;US)
Order-Disorder Transformations
First principles theory of Fermi-surface driven concentration waves in Cu/sub c/Pd/sub 1-c/ alloys, 10:11328 (R;US)
Phase Transformations
Kondo-lattice—mixed-valence resistance scaling in heavy-fermion $CeCu_6$ under pressure, 10:11359 (J;US)
Thermal Diffusion
Analysis of concentration profiles for fluxes, diffusion depths, and zero-flux planes in multicomponent diffusion, 10:11368 (J;US)
COPPER COMPOUNDS
Ion Exchange
Studies of cation exchange for the isolation and concentration of trace level components of complex aqueous mixtures, 10:10974 (R;US)
CORN (MAIZE)
See MAIZE
CORN STOVER
See MAIZE
CORONA DISCHARGES
Correlations
Electrostatic precipitation research part A: electrical properties, 10:10845 (R;AU)
CORROSION
See also PITTING CORROSION
Probes
Applications of the vibration probe to localized current measurements, 10:11326 (R;US)
COSMIC GAMMA BURSTS
Meetings
High energy transients in astrophysics , 10:11746 (B;US)
COSMIC X-RAY BURSTS
Meetings
High energy transients in astrophysics , 10:11746 (B;US)
COSMIC X-RAY SOURCES
See also COSMIC X-RAY BURSTS
X-Ray Spectra
1973 x-ray transient V0332+53, 10:11745 (J;US)
COSMOLOGICAL MODELS
Density
Origin of cosmological density fluctuations, 10:11739 (R;US)
Magnetic Monopoles
Superheavy magnetic monopoles and the standard cosmology, 10:11738 (R;US)
COSMOS
See UNIVERSE
COUNTERFLOW COOLING TOWERS
See COOLING TOWERS
COUNTERS (RADIATION)
See RADIATION DETECTORS
CRAFTSMEN
Renewable Resources
Technology, renewable resources, and American crafts: background paper, 10:11224 (R;US)
CREEKS
See STREAMS
CREEP
Crack Propagation
Creep crack growth in ductile alloys, 10:11332 (R;US)
CRISTOBALITE
Bond Lengths
Crystal structure of low cristobalite at 10, 293, and 473 K: Variation of framework geometry with temperature, 10:11353 (J;US)
Crystal Structure
Crystal structure of low cristobalite at 10, 293, and 473 K: Variation of framework geometry with temperature, 10:11353 (J;US)
CRITICAL ASSEMBLIES
See ZERO POWER REACTORS
CRITICALITY
Safety
Criticality safety training at the Hot Fuel Examination Facility, 10:11482 (R;US)
Training
Criticality safety training at the Hot Fuel Examination Facility, 10:11482 (R;US)
CRITICALITY ACCIDENTS
See CRITICALITY
RADIATION ACCIDENTS
CROSSFLOW COOLING TOWERS
See COOLING TOWERS
CRUDE OIL
See PETROLEUM
CRYPT CELLS
Biological Radiation Effects
Relative biological effectiveness measurements using murine lethality and survival of intestinal and hematopoietic stem cells after Fermilab neutrons compared to JANUS reactor neutrons and ^{60}Co gamma rays, 10:11681 (J;US)
CRYSTAL LATTICES
Phonons
Bulletin of the Electrotechnical Laboratory, Volume 48, No. 7, July 1984, 10:11942 (R;JP;In Japanese)
CRYSTALS
Radiation Effects
Bulk and surface damage thresholds of crystals and glasses at 248 nm, 10:11424 (J;US)
CULTURAL RESOURCES
Management
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 3, Appendix B: archaeological considerations, 10:11193 (R;US)
Renewable Resources
Technology, renewable resources, and American crafts: background paper, 10:11224 (R;US)
CURIUM
Chemistry
Frontiers of chemistry for americium and curium, 10:11473 (R;US)
Magnetic Properties
Magnetism of the heavy 5f elements, 10:11378 (J;CH)
CURRENT-DRIVE HEATING
Waveguides
Coupling to the fast wave via a phased waveguide array, 10:11967 (J;AT)
CUSP
See CUSPED GEOMETRIES
CUSPED GEOMETRIES
Flute Instability
Suppression of flute instability in an axisymmetric double-cusp plasma by RF ponderomotive force, 10:11960 (J;AT)
CYANIDES
Specific compounds, except those of significance to energy research and development, should be indexed by coordination of a descriptor of the form (CATION) COMPOUNDS and the above anion descriptor.
Ion Exchange Chromatography
Selectivity variations in anion chromatography, 10:11428 (R;US)
CYCLONE SEPARATORS
Dynamics and segregation of particles in a cyclone, 10:11523 (R;DE;In German)
CYCLOPHOSPHAMIDE
See ENDOXAN

D

D MESONS
Prior to Jan. 1985 this information was indexed with the descriptor D-1865 RESONANCES.
Particle Production
Study of charm production in proton-proton interactions at $\sqrt{s}$ = 62 GeV with a forward K^- trigger, 10:11823 (R;US)
Weak Hadronic Decay
Study of charm production in proton-proton interactions at $\sqrt{s}$ = 62 GeV with a forward K^- trigger, 10:11823 (R;US)
Weak Particle Decay
Recent results from PEP, 10:11821 (R;US)
D* PLUS RESONANCES
See D-2007 RESONANCES
D* ZERO RESONANCES
See D-2007 RESONANCES
D-1865 RESONANCES
See D MESONS
D-2007 RESONANCES
Hadronic Particle Decay
Study of charm production in proton-proton interactions at $\sqrt{s}$ = 62 GeV with a forward K^- trigger, 10:11823 (R;US)
Particle Production
Study of charm production in proton-proton interactions at $\sqrt{s}$ = 62 GeV with a forward K^- trigger, 10:11823 (R;US)
DAPHNIA
Mortality
Survival, respiration, and food assimilation of Daphnia magna exposed to petroleum- and coal-derived oils at three temperatures, 10:11704 (J;CA)
DARRIEUS ROTORS
Speed Regulators
Darrieus rotor with forward tilting blade speed control, 10:11064 (J;US)
DATA ACQUISITION SYSTEMS
Fastbus System
SLAC Scanner Processor: a FASTBUS module for data collection and processing, 10:11554 (R;US)
DATA ANALYSIS
Accuracy
Maximum ratio: a tool for assisting inaccuracy assessment, 10:12031 (J;US)
DATA BASE MANAGEMENT
Future database machine architectures, 10:12007 (R;US)
DATA PROCESSORS
See DIGITAL COMPUTERS
DATA STORAGE DEVICES
See MEMORY DEVICES
DATA TRANSMISSION
Bulletin of the Electrotechnical Laboratory, Volume 48, No. 7, July 1984, 10:11942 (R;JP;In Japanese)
DATA VALIDATION
See INFORMATION VALIDATION
DAYLIGHTING
Daylighting data for atrium design, 10:11291 (R;US)
DC SYSTEMS
Underground Power Transmission
Evaluation of underground dc transmission systems. Final report, 10:11070 (R;US)
DECONTAMINATION
Economics
Decontamination pays off for nuke owners, 10:11089 (J;US)
DECONTAMINATION FACTOR
See DECONTAMINATION
DEEP INELASTIC HEAVY ION REACTIONS
Dissipation Factor
Dissipation and fluctuation of the relative momentum in nucleus-nucleus collisions, 10:11892 (R;DE)
Statistical Models
Quantum interference and statistical fluctuations in deep inelastic heavy-ion reactions, 10:11891 (R;DE)
DEHYDROGENASES
See OXIDOREDUCTASES
DELTA RAYS
Energy Spectra
Mean delta-ray energies in ion-molecule collisions, 10:11900 (R;US)
DENTISTRY
Biomedical Radiography
Experiments for improving the roentgen imaging and thus the caries diagnosis in the approximal space of lateral teeth, 10:11648 (R;DE;In German)
DEOXYCYTIDINURIA
See URINE
DEOXYPENTOSE NUCLEIC ACID
See DNA
DEOXYRIBONUCLEIC ACID
See DNA
DEOXYURIDINE
Mutagenesis
SCE induction is proportional to substitution in DNA for thymidine by CldU and BrdU, 10:11709 (J;NL)
DEPARTMENT OF DEFENSE
See US DOD
DEPARTMENT OF INTERIOR
See US DOI
DEPLETED URANIUM
Fracture Properties
Evaluation of fracture toughness (J/sub IC/) using single specimen fracture test augmented by finite element analysis, 10:11371 (J;US)
DEREGULATION
Economic Impact
Effects of oil deregulation on public transportation. Final report, 10:11213 (R;US)
DESERTRON
See SUPERCONDUCTING SUPER COLLIDER
DESOXYRIBONUCLEIC ACID
See DNA
DESULFURIZATION
Feasibility Studies
Research and development for advanced combined NO/sub x//SO_2 removal systems. Technical progress report No. 15, October 29, 1984-November 30, 1984, 10:10869 (R;US)
DETECTORS (RADIATION)
See RADIATION DETECTORS
DETONATIONS
Simulation
Model for high rate gas flows in deformable and reactive porous beds, 10:11582 (R;US)
DEUTERIUM
Diffusion
Diffusion of deuterium and hydrogen in rutile TiO_2 crystals at low temperatures, 10:11398 (J;US)
Neutron Diffraction
Structure and thermal expansion in solid deuterium, 10:11419 (J;US)
Phase Studies
Review of deuterium triple-point temperatures, 10:11453 (J;US)
DEUTERIUM OXIDES
See HEAVY WATER
DEUTERIUM TARGET
Deuteron Reactions
Bremsstrahlung and radiative processes at medium energies, 10:11867 (R;CA)
Proton spectra diagnostics for shock-compression studies, 10:11956 (J;US)
Electron Reactions
Theoretical nuclear reaction and structure studies using kaons and photons. Progress report, 10:11866 (R;US)
DEUTERON REACTIONS
Electromagnetic Interactions
Bremsstrahlung and radiative processes at medium energies, 10:11867 (R;CA)
Fusion Reactions
Proton spectra diagnostics for shock-compression studies, 10:11956 (J;US)

Fusion Yield
Proton spectra diagnostics for shock-compression studies, 10:11956 (J;US)

DEUTERON-DEUTERON INTERACTIONS
See DEUTERIUM TARGET
DEUTERON REACTIONS

DEUTERONS
Diffusion
Diffusion of deuterium and hydrogen in rutile TiO_2 crystals at low temperatures, 10:11398 (J;US)

DEVELOPING COUNTRIES
See also BRAZIL
INDONESIA
MOROCCO
SENEGAL
Electric Utilities
Cost-based rates and other conservation options for electric utilities, 10:11217 (RA;US)
Energy efficiency in electrical power generation and industrial sectors, 10:11307 (RA;US)
Energy Conservation
Importance of energy efficiency in the developing countries, 10:11303 (RA;US)
Energy Consumption
Energy efficiency in electrical power generation and industrial sectors, 10:11307 (RA;US)
Industrial Plants
Energy efficiency in electrical power generation and industrial sectors, 10:11307 (RA;US)
Industrial energy management, 10:11304 (RA;US)
Transportation Sector
Transportation/energy analysis: principles and practice, 10:11300 (RA;US)

DIELECTRIC MATERIALS
Electron Collisions
Excitation of edge modes in the interaction of electron beams with dielectric wedges, 10:11774 (J;US)

DIELECTRICS
See DIELECTRIC MATERIALS

DIESEL ENGINES
Competition
Competitivity of gas-driven diesel power plants, 10:11067 (R;FI;In Finnish)
Fuels
Competitivity of gas-driven diesel power plants, 10:11067 (R;FI;In Finnish)

DIESEL FUELS
Chemical Analysis
Utilization research, Volume III. Monthly progress report for November 1984, 10:11321 (R;US)
Combustion Properties
Utilization research, Volume III. Monthly progress report for November 1984, 10:11321 (R;US)
Fuel Substitution
Utilization research, Volume III. Monthly progress report for November 1984, 10:11321 (R;US)
Sales
Petroleum Marketing Monthly, October 1984, 10:10941 (R;US)
Toxicity
Inhalation toxicology of diesel fuel obscurant aerosol in Sprague-Dawley rats. Final report, Phase 3, subchronic exposures, 10:11687 (R;US)
Survival, respiration, and food assimilation of Daphnia magna exposed to petroleum- and coal-derived oils at three temperatures, 10:11704 (J;CA)

DIESEL OIL (FRACTION)
See DIESEL FUELS

DIFFERENTIAL EQUATIONS
See also PARTIAL DIFFERENTIAL EQUATIONS
Numerical Solution
Sparse matrix computations, 10:11926 (R;US)

DIFFRACTION DISSOCIATION
See DIFFRACTION MODELS

DIFFRACTION MODELS
Diffraction: what do we know; what can we learn, 10:11834 (R;US)

DIFFRACTION PRODUCTION
See DIFFRACTION MODELS

DIFFUSION
Computerized Simulation
Computer-simulated random-walk analysis of diffusion in dislocations, 10:11383 (J;CH)
Mathematical Models
Evaluation of a series of SF_6 tracer releases using the MATHEW/ADPIC model (MATHEW/ADPIC Model), 10:11599 (R;US)
Tracer Techniques
Tracer diffusion in an ordered alloy: application of the path probability and Monte Carlo methods, 10:11333 (R;US)

DIGESTER GAS
See METHANE

DIGITAL COMPUTERS
See also SUPERCOMPUTERS
Architecture
Hardware description languages for systolic architectures, 10:12013 (R;US)
Parallel Processing
Hardware description languages for systolic architectures, 10:12013 (R;US)

DIOLS
See GLYCOLS

DIPHENYLPHOSPHINE OXIDE
See ORGANIC PHOSPHORUS COMPOUNDS

DIRAC MONOPOLES
See MAGNETIC MONOPOLES

DISLOCATIONS
See also EDGE DISLOCATIONS
Diffusion
Computer-simulated random-walk analysis of diffusion in dislocations, 10:11383 (J;CH)

DISPERSANTS (CHEMICAL)
See SURFACTANTS

DISPERSE SYSTEMS
See DISPERSIONS

DISPERSIONS
For the state of aggregation in materials; if related to wave phenomena see DISPERSION RELATIONS or OPTICAL DISPERSION.
See also MIXTURES
SUSPENSIONS
Microstructure
Microstructure of two-phase random media. V. The n-point matrix probability functions for impenetrable spheres, 10:11920 (J;US)

DISPERSIVE ION WAVES
See ION PLASMA WAVES

DISSOLVED OXYGEN
See OXYGEN

DISTILLATES
Chemical Composition
Integrated analytical approach to detailed chemical characterization of coal liquefaction process materials, 10:10861 (R;US)
Process-related effects on chemical composition of direct coal liquefaction materials, 10:10862 (R;US)
Fractionation
Integrated analytical approach to detailed chemical characterization of coal liquefaction process materials, 10:10861 (R;US)
Mass Spectroscopy
Integrated analytical approach to detailed chemical characterization of coal liquefaction process materials, 10:10861 (R;US)

DNA
Biological Radiation Effects
Inducible excision repair in Escherichia coli, 10:11685 (BA;US)
Photosensitivity
Mechanisms of photosensititization by furocoumarins, 10:11686 (R;US)

DNA ADDUCTS
Fluorescence Spectroscopy
Fluorescence-line-narrowed spectra of polycyclic aromatic carcinogen-DNA adducts, 10:11642 (J;US)

DNA REPLICATION
Biological Radiation Effects
Delayed inhibition of subchromosomal DNA synthesis in V-79 Chinese hamster cells after γ irradiation, 10:11679 (J;US)
Subchromosomal DNA synthesis in synchronous V-79 Chinese hamster cells after x irradiation, 10:11678 (J;US)
Inhibition
Delayed inhibition of subchromosomal DNA synthesis in V-79 Chinese hamster cells after γ irradiation, 10:11679 (J;US)
Relationship between sister-chromatid exchange and perturbations in DNA replication in mutant EM9 and normal CHO cells, 10:11646 (J;NL)
DOGS
Prenatal Irradiation
CSU-FDA (Colorado State Univ.-Food and Drug Administration) Collaborative Radiological Health Laboratory. Annual report - 1982: health effects of prenatal and postnatal whole-body exposure to ionizing radiation in the beagle dog, 10:11675 (R;US)
Whole-Body Irradiation
CSU-FDA (Colorado State Univ.-Food and Drug Administration) Collaborative Radiological Health Laboratory. Annual report - 1982: health effects of prenatal and postnatal whole-body exposure to ionizing radiation in the beagle dog, 10:11675 (R;US)
DORMITORIES
See RESIDENTIAL BUILDINGS
DOSE REDUCTION FACTOR
See RADIOPROTECTIVE SUBSTANCES
DOSE RELATIVE FACTOR
See RADIOPROTECTIVE SUBSTANCES
DOSIMETRY
See also NEUTRON DOSIMETRY
Research Programs
LWR Pressure Vessel Surveillance Dosimetry Improvement Program. Semiannual progress report, October 1983-March 1984. Volume 1, 10:11088 (R;US)
DOWTHERM
See PHENYL ETHER
DPO
See ORGANIC PHOSPHORUS COMPOUNDS
DRAGLINES
Computerized Simulation
Mining research and development program. Second quarterly report, June 25, 1982-September 25, 1982, 10:10894 (R;US)
DRF
See RADIOPROTECTIVE SUBSTANCES
DRIFT CHAMBERS
Colliding Beams
Test of a high resolution drift chamber prototype, 10:11559 (R;DE)
Data Acquisition Systems
Data preprocessor and compactor for the Soudan 2 nucleon decay experiment, 10:11558 (R;US)
Electronic Circuits
SLAC Mark II upgrade drift chamber front end electronics, 10:11569 (R;US)
Performance
Particle detector performance in a Fermilab experiment (E-615 detector), 10:11548 (R;US)
TASSO vertex detector, 10:11557 (R;DE)
Testing
New drift chamber for the Mark II detector at the SLAC Linear Collider, 10:11568 (R;US)
DRILLING FLUIDS
Limited to materials used in well drilling.
Toxicity
Results of the Drilling Fluids Research Program sponsored by the Gulf Breeze Environmental Research Laboratory, 1976-1983, and their application to hazard assessment. Project summary, 10:10942 (R;US)
DRILLING MUD
See DRILLING FLUIDS
DRY STORAGE
Containers
Storage characteristics of spent HTR fuel elements in transport and storage containers of modular cast iron, 10:11108 (R;DE;In German)
DRYERS
See also SOLAR DRYERS
Computerized Control Systems
[Computerized control of grain drying operations]. Final technical report, 10:11669 (R;US)
Heat Pumps
Application of the heat pump for concentration by evaporation and for drying in agricultural foodstuffs industries, 10:11312 (TG;GB)
DRY-TYPE COOLING TOWERS
See COOLING TOWERS
DTO
See HEAVY WATER
DUAL-PURPOSE POWER PLANTS
Comparative Evaluations
Barriers and incentives to commercialization of fuel cell technology in cogeneration applications. Final report, 10:11274 (R;US)
DYMAC SYSTEM
See NUCLEAR MATERIALS MANAGEMENT
PLUTONIUM
DYNAMIC MATERIALS ACCOUNTABILITY SYSTEM
See NUCLEAR MATERIALS MANAGEMENT
PLUTONIUM
DYSPROSIUM 161
Energy Levels
Nuclear data sheets for A = 161, 10:11880 (J;US)
Energy-Level Transitions
Nuclear data sheets for A = 161, 10:11880 (J;US)

E

EARTH MANTLE
Olivine
Carbon abundances in mantle minerals determined by nuclear reaction analysis, 10:11721 (J;US)
Spinels
Carbon abundances in mantle minerals determined by nuclear reaction analysis, 10:11721 (J;US)
EARTHQUAKES
Forecasting
Catfish Club, 10:11719 (RA;US)
Mobilizing the masses in China, 10:11718 (RA;US)
Public participation in studies of animal behavior prior to earthquakes: some cautionary remarks, 10:11716 (RA;US)
Use of volunteers in the earthquake-hazards-reduction program: proceedings of conference IV, 10:11715 (R;US)
Use of volunteer observers to detect abnormal animal behavior prior to earthquakes, 10:11717 (RA;US)
Use of volunteer organizations in emergency operations, 10:11720 (RA;US)
Meetings
Use of volunteers in the earthquake-hazards-reduction program: proceedings of conference IV, 10:11715 (R;US)
ECHOGRAPHY
See ULTRASONOGRAPHY
ECONOMETRICS
Computer Codes
Model documentation for the mini-macroeconomic model: MINMAC, 10:11182 (R;US)
ECONOMIC REGULATORY ADMINISTRATION
Investigations
Evaluation of the Department of Energy's Economic Regulatory Administration Office in Tulsa, Oklahoma, 10:10945 (R;US)

EDGE DISLOCATIONS
Electric Charges
Dislocation charges in pure and Ca^{++}-doped KCl in the temperature range from 82 to 294 K, 10:11426 (J;GB)
EDS LIQUEFACTION
See EXXON LIQUEFACTION PROCESS
EDTA
Chemical Reactions
Indirect determination of rhenium by EDTA titration, 10:11436 (TJ;US)
EDUCATIONAL FACILITIES
Energy Systems
Eckerd College Energy Systems Project. Final technical report, 10:11287 (R;US)
EFFLUENTS (CHEMICAL)
See CHEMICAL EFFLUENTS
EFFLUENTS (RADIOACTIVE)
See RADIOACTIVE EFFLUENTS
EFFUSION
See DIFFUSION
EIGENVALUES
Algorithms
Algorithms and software for pole assignment and observers, 10:11929 (R;US)
EINSTEIN-DE SITTER MODEL
See COSMOLOGICAL MODELS
ELECTRIC BATTERIES
Devices for production and/or storage of electrical energy from chemical reactions; excludes FUEL CELLS and RADIOISOTOPE BATTERIES.
Performance Testing
Development of aqueous batteries for electric vehicles. Summary report, October 1981-December 1983, 10:11318 (R;US)
Research Programs
Development of aqueous batteries for electric vehicles. Summary report, October 1981-December 1983, 10:11318 (R;US)
Uses
Impact of electric cars on national energy consumption, 10:11302 (J;US)
ELECTRIC CABLES
See also SUPERCONDUCTING CABLES
Electrical Insulation
Numerical model to simulate the processing of electrical distribution cables. Part II. Curing rates, 10:11072 (J;US)
ELECTRIC POWER
See also HYDROELECTRIC POWER
Power Demand
DOE's Collins predicts need for 680 plants by 2000, 10:11315 (J;US)
ELECTRIC POWER INDUSTRY
Electrical Equipment
Coordinated decentralized emergency operating state control, 10:11065 (R;US)
Emergency Plans
Coordinated decentralized emergency operating state control, 10:11065 (R;US)
Energy Conservation
Introduction and background, 10:11282 (RA;US)
Preventive maintenance in the electric power sector, 10:11306 (RA;US)
Maintenance
Preventive maintenance in the electric power sector, 10:11306 (RA;US)
Planning
Proceedings: parallel processing for power system planning and operations, 10:11066 (R;US)
ELECTRIC POWER SYSTEMS
See POWER SYSTEMS
ELECTRIC UTILITIES
Energy Conservation
Conservation's value varies with view, 10:11311 (J;US)
Cost-based rates and other conservation options for electric utilities, 10:11217 (RA;US)
Energy efficiency in electrical power generation and industrial sectors, 10:11307 (RA;US)
Interfaces
Utility interface: can state-of-the-art power conditioners alleviate our concerns?, 10:11048 (RA;US)
Load Management
Cost-based rates and other conservation options for electric utilities, 10:11217 (RA;US)
Operation
Utility interface: can state-of-the-art power conditioners alleviate our concerns?, 10:11048 (RA;US)
Rate Structure
Cost-based rates and other conservation options for electric utilities, 10:11217 (RA;US)
ELECTRICAL EQUIPMENT
See also ANTENNAS
Equipment Protection Devices
Coordinated decentralized emergency operating state control, 10:11065 (R;US)
Outages
Coordinated decentralized emergency operating state control, 10:11065 (R;US)
ELECTRICAL INSULATION
Curing
Numerical model to simulate the processing of electrical distribution cables. Part II. Curing rates, 10:11072 (J;US)
Quenching
Numerical model to simulate the processing of electrical distribution cables. Part II. Curing rates, 10:11072 (J;US)
ELECTRIC-POWERED VEHICLES
Acid Electrolyte Fuel Cells
Electrochemistry of fuel cells for transportation applications, 10:11280 (J;GB)
Electric Batteries
Development of aqueous batteries for electric vehicles. Summary report, October 1981-December 1983, 10:11318 (R;US)
Energy Efficiency
Impact of electric cars on national energy consumption, 10:11302 (J;US)
Hydrogen Fuel Cells
Electrochemistry of fuel cells for transportation applications, 10:11280 (J;GB)
Fuel cell power system for forklift trucks, 10:11258 (RA;US)
ELECTRODES
See also ANODES
CATHODES
Freeze Protection
Carbon monoxide tolerant anodes and freeze resistant electrodes, 10:11259 (RA;US)
Mathematical Models
Molten carbonate fuel cell performance model update. Quarterly report, April-June 1984. Draft, 10:11276 (R;US)
ELECTROLYTE TILES
See MATRIX MATERIALS
ELECTROMAGNETIC FIELDS
Design
Outline of a variational formulation of zone-plate theory, 10:11574 (J;US)
Efficiency
Outline of a variational formulation of zone-plate theory, 10:11574 (J;US)
Health Hazards
Environmental effects of electro-magnetic fields, 10:11713 (TJ;GB)
ELECTROMAGNETIC RADIATION
See also LASER RADIATION
ULTRAVIOLET RADIATION
Dispersion Relations
Electromagnetic inverse problem for dispersive media, 10:11861 (J;US)
Inverse Scattering Problem
Electromagnetic inverse problem for dispersive media, 10:11861 (J;US)
ELECTROMAGNETIC WAVES
See ELECTROMAGNETIC RADIATION

ELECTRON BEAMS
Cherenkov Radiation
Radiation from intense electron beams associated with the Cherenkov mechanism. Technical report, 10:11897 (R;US)
Time development of Cherenkov Radiation. Technical report, 10:11896 (R;US)
ELECTRON CYCLOTRON MASERS
See MICROWAVE AMPLIFIERS
ELECTRON EMISSION
Angular Distribution
Large-angle positronium emission for Al(110), 10:11760 (R;US)
ELECTRON GAS
Structure Factors
Structure factors for a binary mixture of quantum and classical fermion liquids, 10:11804 (J;US)
ELECTRON MICROSCOPES
Brakes
Braking system for use with an arbor of a microscope, 10:11576 (P;US)
ELECTRON REACTIONS
Elastic Scattering
Medium energy physics. Technical progress report, 10:11545 (R;US)
Electroproduction
Theoretical nuclear reaction and structure studies using kaons and photons. Progress report, 10:11866 (R;US)
Fission
Coincidence electron scattering (e,e'f) and multipole strength functions in ^{238}U, 10:11885 (J;US)
ELECTRON SOURCES
Polarized Beams
Medium energy physics. Technical progress report, 10:11545 (R;US)
ELECTRON-ELECTRON COUPLING
Monte Carlo Method
Soliton energetics in extended Peierls-Hubbard models: a quantum Monte Carlo study, 10:11906 (R;US)
ELECTRON-MOLECULE COLLISIONS
Dissociation
Application of R-matrix theory to resonant reactive electron-molecule scattering: Vibrational excitation and dissociative attachment of N_2 and F_2, 10:11797 (J;US)
Noise in strong laser-atom interactions: Frequency fluctuations and nonexponential correlations, 10:11798 (J;US)
Electron Attachment
Application of R-matrix theory to resonant reactive electron-molecule scattering: Vibrational excitation and dissociative attachment of N_2 and F_2, 10:11797 (J;US)
Effect of temperature on nondissociative electron attachment to perfluorobenzene, 10:11773 (J;US)
Noise in strong laser-atom interactions: Frequency fluctuations and nonexponential correlations, 10:11798 (J;US)
Excitation
Application of R-matrix theory to resonant reactive electron-molecule scattering: Vibrational excitation and dissociative attachment of N_2 and F_2, 10:11797 (J;US)
Noise in strong laser-atom interactions: Frequency fluctuations and nonexponential correlations, 10:11798 (J;US)
ELECTRON-PHONON COUPLING
Monte Carlo Method
Soliton energetics in extended Peierls-Hubbard models: a quantum Monte Carlo study, 10:11906 (R;US)
ELECTRON-POSITRON INTERACTIONS
Annihilation
Charged Dsup(*) production in e^+e^- annihilation, 10:11817 (R;DE)
Direct photon production in e^+e^- annihilation, 10:11827 (J;US)
Evidence for Fsup(*) meson production in e^+e^- annihilation at 10 GeV center-of-mass energy, 10:11816 (R;DE)
Evidence for the F/sup / meson, 10:11830 (J;US)
Inclusive electron production from heavy quarks in e^+e^- annihilation at 34.6 GeV center of mass energy, 10:11818 (R;DE)
Measurements of energy correlations in e^+e^--> hadrons, 10:11814 (R;DE)
Search for heavy quarks in e^+e^- collisions up to 46.78 GeV C.M. energy, 10:11815 (R;DE)
Particle Production
Recent results from PEP, 10:11821 (R;US)
Weak Interactions
Weak corrections to the e+e-yields mu+mu- asymmetry, 10:11825 (R;DE)
ELECTRON-PROTON INTERACTIONS
Accelerator Facilities
Design for small angle (0 to 2mr) spectrometer for ep or anti pp collisions at DO, 10:11560 (R;US)
ELECTROSTATIC ACCELERATORS
See also TANDEM ELECTROSTATIC ACCELERATORS
German FR Organizations
Hitherto and future use of the accelerators of the PTA, 10:11531 (R;DE;In German)
Research Programs
Hitherto and future use of the accelerators of the PTA, 10:11531 (R;DE;In German)
ELECTROSTATIC PRECIPITATORS
Operation
Clean-up of producer and synthesis gas with a tube and wire electrostatic precipitator, 10:11024 (J;GB)
Performance
Clean-up of producer and synthesis gas with a tube and wire electrostatic precipitator, 10:11024 (J;GB)
ELECTROSTATIC WAVES
See PLASMA WAVES
ELEMENTARY PARTICLES
See also BEAUTY PARTICLES
CHARM PARTICLES
HADRONS
INTERMEDIATE BOSONS
LEPTONS
POSTULATED PARTICLES
Meetings
Particles and fields - 1983, 10:11811 (B;US)
ELEMENTS
For chemical elements only.
See also METALS
Mass Balance
Trace elements in brown coal and its combustion products, 10:10878 (R;AU)
ELMO BUMPY TORUS
Ballooning Instability
Ballooning modes in the ELMO Bumpy Square configuration using the generalized kinetic energy principle, 10:11940 (RA;US)
Beta Ratio
MHD ballooning modes in the ELMO Bumpy Torus, 10:11939 (RA;US)
Charged-Particle Transport
Introduction to magnetic equilibria and single-particle orbits in the square configuration of EBT: a tutorial, 10:11937 (RA;US)
Design
Conceptual design for ELMO Bumpy Square, 10:11981 (RA;US)
Magnetic Field Configurations
Field error calculations in an ELMO Bumpy Square (EBS), 10:11980 (RA;US)
Magnetics, single-particle drift orbits, and nonresonant electron transport coefficients for the ELMO Bumpy Square, 10:11936 (RA;US)
Magnetic Field Ripples
Ripple effects in ELMO Bumpy Square, 10:11979 (RA;US)
Meetings
ELMO Bumpy Square, 10:11978 (R;US)
Planning
Reactor assessments of advanced bumpy torus configurations, 10:11982 (RA;US)
Plasma Confinement
Magnetics, single-particle drift orbits, and nonresonant electron transport coefficients for the ELMO Bumpy Square, 10:11936 (RA;US)
Plasma Drift
Electron transport in the ELMO bumpy torus in the low collision frequency limit, 10:11962 (J;US)

Plasma Instability
Radial structure of curvature-driven instabilities in a hot-electron plasma, 10:11963 (J;US)
Stability of the ELMO Bumpy Square, 10:11938 (RA;US)
Plasma Macroinstabilities
MHD ballooning modes in the ELMO Bumpy Torus, 10:11939 (RA;US)
Plasma Waves
Observations of low-frequency plasma fluctuations in the Elmo Bumpy Torus, 10:11958 (J;AT)

EMBRYONIC CELLS
Oncogenic Transformations
Transformation of Syrian hamster embryo cells by synfuel mixtures, 10:11694 (J;US)

EMISSION (ELECTRON)
See ELECTRON EMISSION

EMPLOYEES
See PERSONNEL

END USE SECTOR
See COMMERCIAL SECTOR
INDUSTRY
RESIDENTIAL SECTOR
TRANSPORTATION SECTOR

ENDANGERED SPECIES
Management
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 4, Appendix D: endangered and threatened plant species, 10:11194 (R;US)

ENDF
See NUCLEAR DATA COLLECTIONS

ENDOXAN
Biological Effects
Potentiating effects of oxygen in lungs damaged by methylcyclopentadienyl manganese tricarbonyl, cadmium chloride, oleic acid, and antitumor drugs, 10:11693 (J;US)

ENERGY CONSERVATION
Economic Analysis
Importance of energy efficiency in the developing countries, 10:11303 (RA;US)
Financial Assistance
Energy savings one and two years after participation in Minnesota home energy audit and retrofit loan programs, 10:11293 (R;US)
Research Programs
Overview study to identify the potential contribution of technologies to energy conservation in Australian industry, 10:11215 (R;AU)
Technology Assessment
Importance of energy efficiency in the developing countries, 10:11303 (RA;US)

ENERGY CONSUMPTION
Sociology
Energy use: the human dimension, 10:11183 (B;US)

ENERGY POLICY
Human Factors
Energy use: the human dimension, 10:11183 (B;US)
Social Impact
Energy use: the human dimension, 10:11183 (B;US)

ENERGY SUPPLIES
Supply and Demand
Disaggregating regional energy supply/demand and flow data to 173 BEAs in support of the national energy transportation study. Final report (In USA by pipeline, rail, truck and barge; potential bottlenecks between 1955 to 1995), 10:11210 (R;US)
Transport
Disaggregating regional energy supply/demand and flow data to 173 BEAs in support of the national energy transportation study. Final report (In USA by pipeline, rail, truck and barge; potential bottlenecks between 1955 to 1995), 10:11210 (R;US)

ENERGY SYSTEMS
Use only in generic sense; e.g., comparisons of several energy systems or theoretical studies when system is not denoted specifically.
See also COOLING SYSTEMS
IEUS
LIGHTING SYSTEMS
NATURAL GAS DISTRIBUTION SYSTEMS
POWER SYSTEMS
Eckerd College Energy Systems Project. Final technical report, 10:11287 (R;US)
Pipelines
High temperature gas reactor and energy pipeline system, 10:11178 (J;ZZ)
Storage Facilities
High temperature gas reactor and energy pipeline system, 10:11178 (J;ZZ)

ENHANCED RECOVERY
See also MICROBIAL EOR
Coordinated Research Programs
Contracts for field projects and supporting research on enhanced oil recovery. Progress Review No. 39, quarter ending June 30, 1984, 10:10935 (R;US)
Research Programs
Energy production research, Volume I. Monthly progress report for November 1984, 10:10938 (R;US)

ENVIRONMENTAL PARKS
See NATURE RESERVES

ENVIRONMENTAL PROTECTION AGENCY
See US EPA

ENVIRONMENTAL QUALITY
Information Dissemination
Corporate use of information regarding natural resources and environmental quality, 10:11186 (R;US)

ENVIRONMENTAL TRANSPORT
Atmospheres
Experimental determination of the atmospheric dispersion parameters at the Karlsruhe Nuclear Research Center for 160 m and 195 m emission heights. Pt. 2, 10:11610 (R;DE)
Mathematical Models
Treatment of ground deposition, species decay and growth and source height effects in a Lagrangian trajectory model, 10:11605 (J;GB)

ENZYME INHIBITORS
Crystallization
Crystallization of two cubic forms of soybean trypsin inhibitor E-I, a member of the Bowman-Birk inhibitor family, 10:11643 (J;US)

EOR
See ENHANCED RECOVERY

EPA
See US EPA

EPSILON RESONANCES
See ETA-700 RESONANCES

EQUATIONS (DIFFERENTIAL)
See DIFFERENTIAL EQUATIONS

EQUATIONS OF STATE
Correlations
H-Division materials physics quarterly report, April-June 1984, 10:11323 (R;US)

ERBIUM 161
Energy Levels
Nuclear data sheets for A = 161, 10:11880 (J;US)
Energy-Level Transitions
Nuclear data sheets for A = 161, 10:11880 (J;US)

ERBIUM 166 TARGET
Krypton 86 Reactions
Quantum interference and statistical fluctuations in deep inelastic heavy-ion reactions, 10:11891 (R;DE)

ERGONOMICS
See HUMAN FACTORS ENGINEERING

ERYTHROBLASTS
See BONE MARROW CELLS

ESCHERICHIA COLI
DNA Repair
Inducible excision repair in Escherichia coli, 10:11685 (BA;US)

ESTROGENS
Tissue Distribution
Preparation of four fluorine-18-labeled estrogens and their selective uptakes in target tissues of immature rats, 10:11660 (J;US)

Uptake
Preparation of four fluorine-18-labeled estrogens and their selective uptakes in target tissues of immature rats, 10:11660 (J;US)
ESTUARINE ECOSYSTEMS
See AQUATIC ECOSYSTEMS
ETA-700 RESONANCES
Radiative Decay
Resonances in photon-photon scattering, 10:11842 (R;US)
ETA-958 RESONANCES
Radiative Decay
Resonances in photon-photon scattering, 10:11842 (R;US)
1,2-ETHANEDIOL
See GLYCOLS
ETHANOL
Distillation
Solar-powered alcohol still. Final technical report, 10:11020 (R;US)
Recovery
Recovery of ethanol from low concentration solution by adsorption with Silicalite, 10:11021 (R;US)
ETHINE
See ACETYLENE
ETHNIC GROUPS
See MINORITY GROUPS
ETHOCEL
See CELLULOSE
ETHYL ALCOHOL
See ETHANOL
ETHYL RADICALS
Chemical Reaction Kinetics
Reactions of methyl and ethyl radicals with uranium hexafluoride, 10:11470 (J;US)
ETHYLENE
Combustion Kinetics
Combustion characteristics of synthetic liquid fuels. Quarterly technical progress report,January 1-March 31, 1982, 10:11013 (R;US)
Kinetic measurements on elementary fossil fuel combustion reactions over wide temperature ranges. Progress report, May 1, 1984-November 30, 1984, 10:11476 (R;US)
Photoelectron Spectroscopy
Torsional potential and intramolecular dynamics in the $C_2H^+_4$ photoelectron spectra, 10:11788 (J;US)
Photoionization
Torsional potential and intramolecular dynamics in the $C_2H^+_4$ photoelectron spectra, 10:11788 (J;US)
ETHYLENE GLYCOL
See GLYCOLS
ETHYLENEDIAMINETETRAACETIC ACID
See EDTA
ETHYNE
See ACETYLENE
EUROPIUM 152
Sorption
Influence of basalt/groundwater interactions on radionuclide migration, 10:10998 (R;US)
EUROPIUM OXIDES
Binding Energy
Properties of lanthanide oxides as supports for transition metal catalysts. Progress report, May 1, 1984-April 30, 1985, 10:11441 (R;US)
EVALUATED NUCLEAR DATA FILE
See NUCLEAR DATA COLLECTIONS
EXCHANGE (HEAT)
See HEAT TRANSFER
EXCIMER LASERS
(Prior to April, 1984 information was indexed to GAS LASERS and, if possible, the applicable excimer.)
Timing Properties
Low jitter trigger for an excimer laser, 10:11497 (R;US)
Trigger Circuits
Low jitter trigger for an excimer laser, 10:11497 (R;US)
EXCRETION
Computerized Simulation
Four-urn catenary model for excretion, 10:11667 (J;US)
Mathematical Models
Four-urn catenary model for excretion, 10:11667 (J;US)
EXCRETION ANALYSIS
See EXCRETION
EXHAUST GASES
Chemical Analysis
Utilization research, Volume III. Monthly progress report for November 1984, 10:11321 (R;US)
Mutagenesis
Cytotoxicity and mutagenicity of vapor-phase pollutants in rat lung epithelial cells and Chinese hamster ovary cells grown on collagen gels, 10:11697 (J;US)
Toxicity
Cytotoxicity and mutagenicity of vapor-phase pollutants in rat lung epithelial cells and Chinese hamster ovary cells grown on collagen gels, 10:11697 (J;US)
EXPERIMENTAL FACILITIES (ACCELERATOR)
See ACCELERATOR FACILITIES
EXTRACTION (SOLVENT)
See SOLVENT EXTRACTION
EXXON DONOR SOLVENT LIQUEFACTION
See EXXON LIQUEFACTION PROCESS
EXXON LIQUEFACTION PROCESS
Organic Solvents
Process-related effects on chemical composition of direct coal liquefaction materials, 10:10862 (R;US)
Process Solutions
Process-related effects on chemical composition of direct coal liquefaction materials, 10:10862 (R;US)

F

FABRICATION
Limited to the concepts of shaping and manufacturing, use of a more specific term is recommended; for large scale building see CONSTRUCTION.
See also CASTING
Fuel Elements
Use of the DOM software system in quality assurance with the manufacture of fuel elements for nuclear reactors, 10:11104 (RA;DE)
Quality Assurance
Role of the governmental authority in LWR fuel fabrication QA activities in Brazil, 10:11080 (RA;DE)
Quality Control
Economic consequences of QA and QC in fuel and fuel assembly production, 10:11078 (RA;DE)
FACILITIES (ACCELERATOR)
See ACCELERATOR FACILITIES
FACILITIES (EDUCATIONAL)
See EDUCATIONAL FACILITIES
FACILITIES (MILITARY)
See MILITARY FACILITIES
FACILITIES (NUCLEAR)
See NUCLEAR FACILITIES
FACILITIES (STORAGE)
See STORAGE FACILITIES
FALLOUT SHELTERS
Blast Effects
High explosive testing of a corrugated metal blast shelter with membrane blast doors, 10:11581 (R;US)
Doors
High explosive testing of a corrugated metal blast shelter with membrane blast doors, 10:11581 (R;US)
FAR ULTRAVIOLET RADIATION
Wavelength range 2000-400 A.
Biological Effects
Role of the supX gene in sensitizing Salmonella typhimurium cells to respiration shutoff induced by far ultraviolet irradiation, 10:11684 (J;GB)
FAST NEUTRONS
RBE
Relative biological effectiveness measurements using murine lethality and survival of intestinal and hematopoietic stem

cells after Fermilab neutrons compared to JANUS reactor neutrons and ^{60}Co gamma rays, 10:11681 (J;US)
FASTBUS SYSTEM
Programming
FASTBUS software progress, 10:11520 (R;US)
FASTENERS
Design
Locking mechanism for indexing device, 10:11489 (P;US)
FERMENTATION ALCOHOL
See ETHANOL
FERMILAB ACCELERATOR
Facility at Fermi National Accelerator Laboratory, Batavia, Illinois, includes main synchroton, booster synchrotron, and linac.
Drift Chambers
Particle detector performance in a Fermilab experiment (E-615 detector), 10:11548 (R;US)
Multiwire Proportional Chambers
Particle detector performance in a Fermilab experiment (E-615 detector), 10:11548 (R;US)
FERMIONS
See also LEPTONS
Gauge Invariance
Staggered fermions and rotation-gauge invariance, 10:11843 (R;IT)
Lattice Field Theory
Some negative results for avoiding lattice fermionic doubling, 10:11844 (R;IT)
Mass
Derivation of the Wolfenstein form of the Kobayashi-Maskawa matrix from fermion masses, 10:11846 (J;US)
Particle Interactions
Comparison of the canonical Hamiltonian and the Hamiltonian of Callan and Rubakov for the monopole-fermion system, 10:11845 (J;US)
FERRIC COMPOUNDS
See IRON COMPOUNDS
FERROMAGNETIC MATERIALS
Magnetization
Magnetization density of 5f electrons in ferromagnetic PuSb, 10:11361 (J;US)
FERROUS COMPOUNDS
See IRON COMPOUNDS
FIBROBLASTS
Biological Radiation Effects
Subchromosomal DNA synthesis in synchronous V-79 Chinese hamster cells after x irradiation, 10:11678 (J;US)
DNA Repair
Excision repair of ultraviolet- and chemically-induced damage in the DNA of fibroblasts derived from two closely related species of marine fishes, 10:11701 (J;NL)
Sensitivity
Cell specific activation of benzo[a]pyrene by fibroblasts and hepatocytes (Rats), 10:11710 (J;US)
FIELD THEORIES
Gauge Invariance
Symmetries of gauge fields, 10:11860 (J;US)
Research Programs
Technical progress report, November 1, 1983-October 31, 1984, 10:11839 (R;US)
Symmetry
Symmetries of gauge fields, 10:11860 (J;US)
FIELD-REVERSED MIRROR REACTORS
Plasma Confinement
Particle-confinement criteria for axisymmetric field-reversed magnetic configurations, 10:11966 (J;AT)
FIELDS (ELECTROMAGNETIC)
See ELECTROMAGNETIC FIELDS
FIELDS (MAGNETIC)
See MAGNETIC FIELDS
FINANCIAL MANAGMENT
See PROGRAM MANAGEMENT
FINLAND
Coal Deposits
Long term use of Finnish peat resources, 10:10888 (R;FI;In Finnish)
Coal Reserves
Long term use of Finnish peat resources, 10:10888 (R;FI;In Finnish)
FIRE HAZARDS
Detection
Detection of fire hazards in belt conveyors in coal mines, 10:10905 (TG;GB)
FIREDAMP
See METHANE
FISSILE MATERIALS
Group Constants
Least squares fit of thermal data for fissile nuclei, 10:11881 (R;US)
FISSION PRODUCT RELEASE
Coordinate with descriptors for the area of release such as BIOSPHERE or COOLANTS, and for the specific fission products, if known.
Environmental Transport
Experimental determination of the atmospheric dispersion parameters at the Karlsruhe Nuclear Research Center for 160 m and 195 m emission heights. Pt. 2, 10:11610 (R;DE)
U Codes
Frequency distributions of activity concentrations after accidential releases of radionuclides, 10:11165 (R;DE;In German)
FISSIONABLE MATERIALS MANAGEMENT
See NUCLEAR MATERIALS MANAGEMENT
FLAMES
Chemical Composition
Combustion characteristics of synthetic liquid fuels. Quarterly technical progress report,January 1-March 31, 1982, 10:11013 (R;US)
Mathematical Models
Combustion characteristics of synthetic liquid fuels. Quarterly technical progress report,January 1-March 31, 1982, 10:11013 (R;US)
Research Programs
Combustion characteristics of synthetic liquid fuels. Quarterly technical progress report,January 1-March 31, 1982, 10:11013 (R;US)
Turbulence
Combustion characteristics of synthetic liquid fuels. Quarterly technical progress report,January 1-March 31, 1982, 10:11013 (R;US)
FLASKS
See CASKS
FLAT PLATE COLLECTORS
Comparative Evaluations
Comparison of concentrating collectors to tracking flat panels, 10:11029 (RA;US)
Cost
Brookhaven National Laboratory's low cost solar technology, 10:11054 (R;US)
Comparison of concentrating collectors to tracking flat panels, 10:11029 (RA;US)
Design
Brookhaven National Laboratory's low cost solar technology, 10:11054 (R;US)
Performance
Brookhaven National Laboratory's low cost solar technology, 10:11054 (R;US)
Performance Testing
Testing of Zeopower solar collectors for heating and cooling. Final report, 10:11058 (R;US)
Zeolites
Testing of Zeopower solar collectors for heating and cooling. Final report, 10:11058 (R;US)
FLOODS
Risk Assessment
Flood hazard assessment on alluvial fans: an examination of the methodology, 10:11185 (R;US)
FLORIDA
Continental Shelf
Effects of alongshore variation in bottom topography on a boundary current (topographically induced upwelling), 10:11731 (J;GB)

FLOTATION
Reagents
Coal cleaning by froth flotation, 10:10913 (R;US)
Research Programs
Coal cleaning by flotation, 10:10917 (R;AU)
FLOW (FLUID)
See FLUID FLOW
FLOW REGULATORS
See also VALVES
Performance
Performance characteristics of axisymmetric venturi-like reverse-flow diverters. Consolidated Fuel Reprocessing Program, 10:10964 (R;US)
FLUE GAS
Cleaning
Re-heating flue gases from flue gas cleaning plants by means of heat exchangers, 10:10876 (TJ;GB)
Denitrification
[Evaluation of NOXSO combined NO/sub x//SO/sub x/ flue gas cleanup]. Monthly progress report, June 1-June 30, 1983, 10:10866 (R;US)
[Evaluation of NOXSO combined NO/sub x/ and SO_2 flue gas cleanup]. Monthly progress report, April 1-30, 1983, 10:10865 (R;US)
Research and development for advanced combined NO/sub x//SO_2 removal systems. Technical progress report, 10:10868 (R;US)
Desulfurization
[Evaluation of NOXSO combined NO/sub x//SO/sub x/ flue gas cleanup]. Monthly progress report, June 1-June 30, 1983, 10:10866 (R;US)
[Evaluation of NOXSO combined NO/sub x/ and SO_2 flue gas cleanup]. Monthly progress report, April 1-30, 1983, 10:10865 (R;US)
Recent advances in commercial organic-acid-enhanced FGD (flue gas desulfurization) systems. Report for September 1983-July 1984, 10:11527 (R;US)
Research and development for advanced combined NO/sub x//SO_2 removal systems. Technical progress report, 10:10868 (R;US)
Research and development for advanced combined NO/sub x//SO_2 removal systems. Technical progress report No. 15, October 29, 1984-November 30, 1984, 10:10869 (R;US)
Heating
Re-heating flue gases from flue gas cleaning plants by means of heat exchangers, 10:10876 (TJ;GB)
FLUID FLOW
See also GAS FLOW
TURBULENT FLOW
TWO-PHASE FLOW
Computerized Simulation
Three-dimensional lid-driven cavity flow: experiment and simulation, 10:11506 (R;US)
Measuring Methods
Comparison of mass flow calculations using drag disc/turbine transducer (DTT) data from the Transient Flow Calibration Facility, 10:11146 (R;US)
Mixing
Mixing in a stratified recirculating flow, 10:11508 (R;US)
Stratification
Mixing in a stratified recirculating flow, 10:11508 (R;US)
Test Facilities
Three-dimensional lid-driven cavity flow: experiment and simulation, 10:11506 (R;US)
Testing
Three-dimensional lid-driven cavity flow: experiment and simulation, 10:11506 (R;US)
FLUIDIZED-BED COMBUSTION
Commercialization
Update on operating performance of the Battelle Multisolid Fluidized-Bed Combustion process, 10:10920 (R;US)
Design
Update on operating performance of the Battelle Multisolid Fluidized-Bed Combustion process, 10:10920 (R;US)
FLUIDIZED-BED COMBUSTORS
Construction
Engineer, design, construct, test and evaluate a pressurized fluidized bed pilot plant using high sulfur coal for production of electric power. Phase III. Pilot plant construction. Final report, 10:11524 (R;US)
Design
Engineer, design, construct, test and evaluate a pressurized fluidized bed pilot plant using high sulfur coal for production of electric power. Phase III. Pilot plant construction. Final report, 10:11524 (R;US)
First-year's operation of a full-scale second-generation FBC in an industrial plant, 10:10921 (R;US)
Emission
Emissions of two milled peat fired power plants, 10:10877 (R;FI;In Finnish)
Performance
First-year's operation of a full-scale second-generation FBC in an industrial plant, 10:10921 (R;US)
Performance Testing
Use of fluidized bed coal combustion techniques to study efficiency, emission reduction, boiler effects, and waste utilization, 10:10922 (RA;US)
FLUIDS
Not for BODY FLUIDS.
See also DRILLING FLUIDS
HEAT TRANSFER FLUIDS
LIQUIDS
Equations of State
H-Division materials physics quarterly report, April-June 1984, 10:11323 (R;US)
Intermolecular Forces
Perturbation theory of classical equilibrium fluids, 10:11922 (J;US)
Structure Factors
Porosity and specific surface for interpenetrable-sphere models of two-phase random media, 10:11921 (J;US)
Thermal Conductivity
H-Division materials physics quarterly report, April-June 1984, 10:11323 (R;US)
Thermodynamic Properties
Model for the calculation of thermodynamic properties of a fluid: using hard-sphere perturbation theory and the zero-Kelvin isotherm of the solid, 10:11808 (J;US)
Perturbation theory of classical equilibrium fluids, 10:11922 (J;US)
FLUORANTHENE
See CONDENSED AROMATICS
FLUORINATED AROMATIC HYDROCARBONS
Electron Attachment
Effect of temperature on nondissociative electron attachment to perfluorobenzene, 10:11773 (J;US)
Electron-Molecule Collisions
Effect of temperature on nondissociative electron attachment to perfluorobenzene, 10:11773 (J;US)
FLUORINE
Chemical Reaction Kinetics
Improved potential energy surface for $F+H_2 \rightarrow HF+H$ and $H+H'F \rightarrow HF+H'$, 10:11447 (J;US)
Electron-Molecule Collisions
Application of R-matrix theory to resonant reactive electron-molecule scattering: Vibrational excitation and dissociative attachment of N_2 and F_2, 10:11797 (J;US)
Noise in strong laser-atom interactions: Frequency fluctuations and nonexponential correlations, 10:11798 (J;US)
FLUORINE FLUORIDES
See FLUORINE
FLUTE INSTABILITY
Stabilization
Stabilization of interchange modes in mirror plasma devices by radio-frequency sideband coupling, 10:11948 (J;US)
Suppression of flute instability in an axisymmetric double-cusp plasma by RF ponderomotive force, 10:11960 (J;AT)
FLY ASH
Electric Conductivity
Electrostatic precipitation research part A: electrical properties, 10:10845 (R;AU)
Examination of the mineral components of coal and its resultant fly ash in relation to resistivity characteristics of the fly ash, 10:10855 (R;AU)

Electrical Properties
Electrostatic precipitation research part A: electrical properties, 10:10845 (R;AU)
Environmental Impacts
Summary of environmental impact assessment studies at the Vienna fly-ash disposal site. Final report, 10:10870 (R;US)
Photoelectron Spectroscopy
Examination of the mineral components of coal and its resultant fly ash in relation to resistivity characteristics of the fly ash, 10:10855 (R;AU)
Pneumatic Transport
Dense phase pneumatic conveying of pulverised coal, 10:10918 (R;AU)
Waste Product Utilization
Potential resources from coal fly ash, 10:10863 (R;US)
X-Ray Diffraction
Examination of the mineral components of coal and its resultant fly ash in relation to resistivity characteristics of the fly ash, 10:10855 (R;AU)
X-Ray Fluorescence Analysis
Examination of the mineral components of coal and its resultant fly ash in relation to resistivity characteristics of the fly ash, 10:10855 (R;AU)

FOILS
Thinner than PLATES or SHEETS.
Explosions
Exploding foil technique for achieving a soft x-ray laser, 10:11498 (J;US)

FOOD CHAINS
Radionuclide Migration
Field studies on the terrestrial behavior of actinide elements in East Tennessee, 10:11619 (R;US)

FORESTRY
Acid Rain
Acid rain and forestry, 10:11591 (R;GB)
Management
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 6, Appendix F: forest management, 10:11196 (R;US)

FORMALDEHYDE
Emission
Comparison of wet and dry desiccator test methods for formaldehyde emission from UF-bonded wood products, 10:11603 (J;US)
Measuring Methods
Comparison of wet and dry desiccator test methods for formaldehyde emission from UF-bonded wood products, 10:11603 (J;US)
Mutagenesis
Cytotoxicity and mutagenicity of vapor-phase pollutants in rat lung epithelial cells and Chinese hamster ovary cells grown on collagen gels, 10:11697 (J;US)
Toxicity
Cytotoxicity and mutagenicity of vapor-phase pollutants in rat lung epithelial cells and Chinese hamster ovary cells grown on collagen gels, 10:11697 (J;US)
Open-ended rat tracheal implant model: toxic effects of formaldehyde on the respiratory epithelium, 10:11699 (J;NL)

FORMALIN
See FORMALDEHYDE

FORMALITH
See FORMALDEHYDE

FORMIC ALDEHYDE
See FORMALDEHYDE

FORMOL
See FORMALDEHYDE

FOSSIL-FUEL POWER PLANTS
Air Pollution
Characterization of polycyclic organic matter (POM) from coal-fired power plants in the atmosphere and investigation of their transformation in the atmosphere, 10:10880 (R;DK;In Danish)
Combustion Products
Characterization of polycyclic organic matter (POM) from coal-fired power plants in the atmosphere and investigation of their transformation in the atmosphere, 10:10880 (R;DK;In Danish)
Competition
Competitivity of gas-driven diesel power plants, 10:11067 (R;FI;In Finnish)
Emission
Emissions of two milled peat fired power plants, 10:10877 (R;FI;In Finnish)
Trace elements in brown coal and its combustion products, 10:10878 (R;AU)
Fly Ash
Summary of environmental impact assessment studies at the Vienna fly-ash disposal site. Final report, 10:10870 (R;US)

FRACTURE PROPERTIES
Regression Analysis
Fitting curves to toughness data, 10:11514 (J;US)

FRACTURE STRENGTH
See FRACTURE PROPERTIES

FRACTURE TOUGHNESS
See FRACTURE PROPERTIES

FRACTURES
See also HYDRAULIC FRACTURES
Fluid Flow
Effects of fracture roughness on fluid flow through a single deformable fracture, 10:11725 (R;US)

FRAGMENTATION
Fracture Mechanics
Mechanisms of dynamic fragmentation: factors governing fragment size, 10:11478 (R;US)

FREE CONVECTION
See NATURAL CONVECTION

FREE ELECTRON LASERS
Beam Dynamics
Synchrotron-betatron resonances in free-electron lasers, 10:11500 (J;US)
Betatron Oscillations
Synchrotron-betatron resonances in free-electron lasers, 10:11500 (J;US)
Excitation
Measurement of the transverse mode excitation in the stimulated emission of the ACO free electron laser. Final report 15 September-31 December 1983, 10:11495 (R;US)

FREE RADICALS
See RADICALS

FRESH WATER
Water Pollution
Acid rain and forestry, 10:11591 (R;GB)

FRESH WATER ECOSYSTEMS
See AQUATIC ECOSYSTEMS

F*RESONANCES
Radiative Decay
Evidence for Fsup(*) meson production in $e^+ e^-$ annihilation at 10 GeV center-of-mass energy, 10:11816 (R;DE)
Rest Mass
Evidence for Fsup(*) meson production in $e^+ e^-$ annihilation at 10 GeV center-of-mass energy, 10:11816 (R;DE)

FRM DEVICES (THERMONUCLEAR)
See FIELD-REVERSED MIRROR REACTORS

FUEL ASSEMBLIES
Fabrication
Experience with quality assurance in fuel design and manufacturing, 10:11100 (RA;DE)
QA/QC for nuclear fuel fabrication at ASEA-Atom, Sweden, 10:11082 (RA;DE)
Surveillance by EDF of PWR fuel assembly fabrication, 10:11103 (RA;DE;In French)
Quality Assurance
Experience with quality assurance in fuel design and manufacturing, 10:11100 (RA;DE)
QA/QC for nuclear fuel fabrication at ASEA-Atom, Sweden, 10:11082 (RA;DE)
Surveillance by EDF of PWR fuel assembly fabrication, 10:11103 (RA;DE;In French)
Quality Control
LR-0 research reactor experimental fuel production control, 10:11135 (RA;DE;In Russian)
Methods for QC fuel assemblies, 10:11084 (RA;DE)

QA/QC for nuclear fuel fabrication at ASEA-Atom, Sweden, 10:11082 (RA;DE)
Quality control considerations in fuel assembly fabrication for natural uranium reactors, 10:11109 (RA;DE;In French)

FUEL CANS

Chemical Analysis
Methods and procedures of chemical analyses of zircaloy tubing, 10:11127 (RA;DE)

Corrosion Resistance
Zircaloy cladding corrosion degradation in a Tuff repository: initial experimental plan, 10:10973 (R;US)

Fabrication
Quality techniques implemented during the fabrication phase of additivates and barrier fuel pellets and bundles, 10:11102 (RA;DE)

Quality Control
Computerized ultrasonic tube testing systems with special reference to the installation in tube mills for nuclear tubing of fuel fabrication facilities, 10:11106 (RA;DE)
Methods and procedures of chemical analyses of zircaloy tubing, 10:11127 (RA;DE)
Methods of quality control for Zircaloy tubing, 10:11105 (RA;DE)
Quality techniques implemented during the fabrication phase of additivates and barrier fuel pellets and bundles, 10:11102 (RA;DE)
Statistical methods in the quality control of UO_2 pellets and Zircaloy cladding tubes for water-reactor fuel rods, 10:11081 (RA;DE)

Zircaloy
Methods and procedures of chemical analyses of zircaloy tubing, 10:11127 (RA;DE)
Methods of quality control for Zircaloy tubing, 10:11105 (RA;DE)

FUEL CELL POWER PLANTS
For commercial, residential, or electric utility use.

Cogeneration
Assessment of options for small-scale lignite fueled cogeneration plants, 10:11244 (RA;US)
Barriers and incentives to commercialization of fuel cell technology in cogeneration applications. Final report, 10:11274 (R;US)

Commercialization
Barriers and incentives to commercialization of fuel cell technology in cogeneration applications. Final report, 10:11274 (R;US)
Fuel motivated approach to fuel cell application, 10:11243 (RA;US)

Cost
Assessment of options for small-scale lignite fueled cogeneration plants, 10:11244 (RA;US)

Demonstration Plants
4.5 MW fuel cell power plant test at Tokyo Electric Power Company, 10:11240 (RA;US)
4.8-megawatt demonstrator. Progress report, 10:11239 (RA;US)

Design
Westinghouse fuel cell power plant design, 10:11242 (RA;US)

Economics
Techno-economic evaluation of a direct fuel cell system, 10:11234 (RA;US)

Fuel Systems
High pressure type PAFC development for concentrated generation, 10:11267 (RA;US)

Fuels
Fuel motivated approach to fuel cell application, 10:11243 (RA;US)

Marketing Research
Applications of fuel cell power plants in Japanese utility use, 10:11272 (RA;US)

Mathematical Models
Computer model of UTC 11-MW fuel cell power plant, 10:11248 (RA;US)

Modifications
Electric utility PAFC technology development progress, 10:11241 (RA;US)

Optimization
R and D of phosphoric acid fuel cell technologies and systems for a dispersed power plant, 10:11266 (RA;US)

Performance Testing
4.5 MW fuel cell power plant test at Tokyo Electric Power Company, 10:11240 (RA;US)
4.8-megawatt demonstrator. Progress report, 10:11239 (RA;US)

Sensitivity Analysis
Techno-economic evaluation of a direct fuel cell system, 10:11234 (RA;US)

FUEL CELLS
See also ACID ELECTROLYTE FUEL CELLS
COAL FUEL CELLS
HIGH-TEMPERATURE FUEL CELLS
HYDROGEN FUEL CELLS
REGENERATIVE FUEL CELLS
Energy conservation by on-site fuel cells, 10:11232 (RA;US)

Cogeneration
Barriers and incentives to commercialization of fuel cell technology in cogeneration applications. Final report, 10:11274 (R;US)

Commercialization
Barriers and incentives to commercialization of fuel cell technology in cogeneration applications. Final report, 10:11274 (R;US)
Overview of fuel cell development under the Moonlight Project, 10:11265 (RA;US)
Progress in on-site fuel cell technology development, 10:11233 (RA;US)

Electrocatalysts
Electrochemical and surface science research on fuel cells, 10:11262 (RA;US)

Electrochemistry
Electrochemical and surface science research on fuel cells, 10:11262 (RA;US)

Mathematical Models
Computer-based fuel ceil analytical tools: description and availability, 10:11247 (RA;US)
PSI: mechanistic fuel cell modeling, 10:11249 (RA;US)

Meetings
1983 national fuel cell seminar. Program and abstracts, 10:11227 (R;US)

Performance
PSI: mechanistic fuel cell modeling, 10:11249 (RA;US)

Uses
Development of fuel cell technology for industrial applications, 10:11252 (RA;US)
Fuel cells for chlor-alkali plants, 10:11251 (RA;US)
Potential fuel cell application in the metallurgical industries, 10:11250 (RA;US)

FUEL COOLING INSTALLATIONS
See SPENT FUEL STORAGE

FUEL CYCLE

Environmental Effects
Environmental assessment: DOE program to improve uranium utilization in light water reactors, 10:11125 (R;US)

FUEL ELEMENTS
See also FUEL PINS
FUEL RODS
SPENT FUEL ELEMENTS

Fabrication
Economic consequences of QA and QC in fuel and fuel assembly production, 10:11078 (RA;DE)
Performance-related characteristics of water reactor fuel - an update, 10:11087 (RA;DE)
Practical experience in the application of quality control in water-reactor fuel fabrication, 10:11099 (R;DE)
Role of the governmental authority in LWR fuel fabrication QA activities in Brazil, 10:11080 (RA;DE)
Statistical evaluation of fuel and fuel assembly production, 10:11101 (RA;DE)

Meetings
Practical experience in the application of quality control in water-reactor fuel fabrication, 10:11099 (R;DE)

Performance
Performance-related characteristics of water reactor fuel - an update, 10:11087 (RA;DE)

Quality Assurance
Experiences in the application of quality control and quality assurance programmes in water reactor fuel fabrication, 10:11110 (RA;DE)
Use of the DOM software system in quality assurance with the manufacture of fuel elements for nuclear reactors, 10:11104 (RA;DE)
Quality Control
Experiences in the application of quality control and quality assurance programmes in water reactor fuel fabrication, 10:11110 (RA;DE)
Practical experience in the application of quality control in water-reactor fuel fabrication, 10:11099 (R;DE)
Principles governing the organization of quality control in the fabrication of water reactor fuel elements, 10:11107 (RA;DE)
Quality control and performance of PHWR fuel in India, 10:11111 (RA;DE)
Technology and performance of water reactor fuel, 10:11079 (RA;DE)

FUEL FABRICATION PLANTS
Quality Control
Continuous inspection during fabrication, 10:11126 (RA;DE;In French)

FUEL INJECTION SYSTEMS
Design
Pellet fuelling development at Oak Ridge National Laboratory, 10:12002 (BA;GB)

FUEL OILS
See also RESIDUAL FUELS
Sales
Petroleum Marketing Monthly, October 1984, 10:10941 (R;US)
Toxicity
Survival, respiration, and food assimilation of Daphnia magna exposed to petroleum- and coal-derived oils at three temperatures, 10:11704 (J;CA)

FUEL PELLETS
Fabrication
Quality techniques implemented during the fabrication phase of additivates and barrier fuel pellets and bundles, 10:11102 (RA;DE)
Technical and administrative implementation of QA and QC during fabrication of additivated and barrier fuel pellets, 10:10960 (RA;DE)
Quality Assurance
Technical and administrative implementation of QA and QC during fabrication of additivated and barrier fuel pellets, 10:10960 (RA;DE)
Quality Control
Physical methods of quality control of fuel pellets, 10:10962 (RA;DE)
Quality techniques implemented during the fabrication phase of additivates and barrier fuel pellets and bundles, 10:11102 (RA;DE)
Statistical methods in the quality control of UO_2 pellets and Zircaloy cladding tubes for water-reactor fuel rods, 10:11081 (RA;DE)
Technical and administrative implementation of QA and QC during fabrication of additivated and barrier fuel pellets, 10:10960 (RA;DE)

FUEL PENCILS
See FUEL PINS

FUEL PINS
Creep
Fuel transient deformation, 10:11128 (J;NL)
Deformation
Fuel transient deformation, 10:11128 (J;NL)

FUEL RODS
Pressure Measurement
Measurement of the inner pressure of a fuel rod and determination of the filling gas purity, 10:11086 (RA;DE)

FUEL SHEATHS
See FUEL CANS

FUEL SLUGS
See FUEL RODS

FUEL SLURRIES
Chemical Preparation
Conceptual design and economic analysis for the manufacture of an ultra-clean coal/water mixture. Final report, 10:10910 (R;US)
Combustion
Fine particle coal as a source of energy in small user applications, 10:10923 (RA;US)
Combustion Properties
Fine particle coal as a source of energy in small user applications, 10:10923 (RA;US)
Cost
Conceptual design and economic analysis for the manufacture of an ultra-clean coal/water mixture. Final report, 10:10910 (R;US)
Gelation
Coal liquefaction research. Quarterly report, April-June 1984, 10:10849 (R;US)
Pumping
Hydrocylcone system for recovery of low-sulfur coal fines from gob, 10:10907 (RA;US)
Specifications
Conceptual design and economic analysis for the manufacture of an ultra-clean coal/water mixture. Final report, 10:10910 (R;US)
Staged Combustion
Coal water mixture combustion in Multiannular Swirl Burner (MASB). Low Emission Combustor Technology Program. Draft, 10:10924 (R;US)

FUEL SUSPENSIONS
See FUEL SLURRIES

FUEL-CLADDING INTERACTIONS
Materials Testing
Preliminary observation of large scale UO_2 melt-concrete interactions and sustained steel-concrete interaction with an overlying water pool, 10:11173 (R;US)

FUELS (NUCLEAR)
See NUCLEAR FUELS

FUMES
See AEROSOLS

FUNDAMENTAL PARTICLES
See ELEMENTARY PARTICLES

FURANS
Hydrogenation
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 1, October-December 1983, 10:11458 (R;US)
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 3, April-June 1984, 10:11460 (R;US)
Toxicity
Pathology of acute inhalation exposure to 3-methylfuran in the rat and hamster, 10:11708 (J;US)

FURNACES
See also BLAST FURNACES
Energy Efficiency
Sliding-Bed (trademark) aluminum-scrap preheater. Final report, October 1982-May 1984, 10:11310 (R;US)
Heat Transfer
Combustion and heat transfer in pulverised coal fired furnaces, 10:10928 (R;AU)

FUSED SALTS
See MOLTEN SALTS

FUSION FUELS
See THERMONUCLEAR FUELS

FUSION REACTORS
See THERMONUCLEAR REACTORS

G

GADOLINIUM 161
Energy Levels
Nuclear data sheets for A = 161, 10:11880 (J;US)

Energy-Level Transitions
Nuclear data sheets for A = 161, 10:11880 (J;US)
GADOLINIUM COMPOUNDS
Physical Radiation Effects
Self-radiation damage in actinide host phases of nuclear waste forms ($Ca_3Nd_8(SiO_4)_6O_2$; $Gd_2Ti_2O_7$; $CaZrTi_2O_7$), 10:10981 (R;US)
GALAXIES
X-Ray Spectra
Studies of X-ray clusters of galaxies/intergalactic plasmas. Final Report, 10:11742 (R;US)
GALLIUM ARSENIDE SOLAR CELLS
Electric Potential
Applicability of the Meyer—Neldel rule to solar cells, 10:11039 (J;US)
Radiation Effects
Radiation Damage Workshop, 10:11026 (R;US)
GAMMA SOURCES
For cosmic sources of gamma radiation use COSMIC GAMMA SOURCES.
Modifications
Beneficial uses of nuclear byproducts/Sewage Sludge Irradiation Project. Progress report, January-June 1983, 10:11008 (R;US)
GAMMA SPECTROSCOPY
Applications of new absolute measurements of x-rays and gamma-rays. Final report, 10:11565 (R;US)
GANGLIONS
Biomedical Radiography
Cysts of the semilunar cartilage. Pathogenesis, clinical symptoms and radiology considering also pneumo-arthrographic findings, 10:11653 (R;DE;In German)
GAS CHROMATOGRAPHY
Gaseous Diffusion
Effect of liquid-phase diffusion resistance on retention time in gas-liquid chromatography, 10:11435 (J;US)
GAS FLOW
Onsager Relations
Solution of the Onsager equation in doubly connected regions, 10:11806 (J;US)
GAS GENERATORS
Design
Wood power: experiments with a home-made wood gas generator system, 1982-1984, 10:11015 (R;US)
GAS SPILLS
Diffusion
Results of recent large-scale NH_3 and N_2O_4 dispersion experiments, 10:11598 (R;US)
GAS WELLS
See NATURAL GAS WELLS
GASOLINE
Sales
Petroleum Marketing Monthly, October 1984, 10:10941 (R;US)
GASTEROPODS
See MOLLUSCS
GE SEMICONDUCTOR DETECTORS
Performance
^{76}Ge double beta decay experiment at Homestake, 10:11566 (R;US)
GEARS
Fasteners
Locking mechanism for indexing device, 10:11489 (P;US)
Positioning
Locking mechanism for indexing device, 10:11489 (P;US)
GENERATORS (STEAM)
See STEAM GENERATORS
GEOLOGIC FAULTS
Mathematical Models
Dislocation model of the stress history dependence of frictional slip, 10:11726 (J;US)
Stress Analysis
Dislocation model of the stress history dependence of frictional slip, 10:11726 (J;US)
GEOLOGIC STRUCTURES
See also SEDIMENTARY BASINS
Mapping
Geologic structure mapping database Spent Fuel Test - Climax, Nevada Test Site, 10:10992 (R;US)
GEOTHERMAL ENERGY
Demonstration Programs
Geothermal research and development activities of the U.S. Department of Energy, 10:11225 (BA;NZ)
Research Programs
Appropriate Technology Small Grants Program. Code case studies, 10:11222 (R;US)
Geothermal research and development activities of the U.S. Department of Energy, 10:11225 (BA;NZ)
GERMANIUM
Atom Transport
Low-temperature ion beam mixing of Pt and Si markers in Ge, 10:11416 (J;US)
Binding Energy
Surface core-level shifts for Ge(100)-(2 x 1), 10:11375 (J;GB)
Electrical Properties
Compensation of dangling bonds in A-Si, Ge:H alloys. Annual report, 10:11036 (R;US)
Ion Collisions
Low-temperature ion beam mixing of Pt and Si markers in Ge, 10:11416 (J;US)
Laser-Radiation Heating
Time resolved x-ray studies during pulsed laser irradiation of Ge, 10:11329 (R;US)
Mixing
Low-temperature ion beam mixing of Pt and Si markers in Ge, 10:11416 (J;US)
Molecular Structure
Predictions of the bond length and vibrational frequency of Ge_2, 10:11800 (J;NL)
Physical Radiation Effects
Low-temperature ion beam mixing of Pt and Si markers in Ge, 10:11416 (J;US)
Sputtering
Compensation of dangling bonds in A-Si, Ge:H alloys. Annual report, 10:11036 (R;US)
Temperature Distribution
Time resolved x-ray studies during pulsed laser irradiation of Ge, 10:11329 (R;US)
GERMANIUM ALLOYS
Electrical Properties
Compensation of dangling bonds in A-Si, Ge:H alloys. Annual report, 10:11036 (R;US)
Sputtering
Compensation of dangling bonds in A-Si, Ge:H alloys. Annual report, 10:11036 (R;US)
GERMANIUM DETECTORS
See GE SEMICONDUCTOR DETECTORS
GERMS (MICROORGANISMS)
See MICROORGANISMS
GES FUER REAKTORSICHERHEIT
A section of the Technical Inspection Associations of the German Federal Republic
Research Programs
List of reports on reactor safety research of BMFT, CEA, EPRI, JSTA and USNRC, 10:11162 (R;DE;In German)
Reviews
List of reports on reactor safety research of BMFT, CEA, EPRI, JSTA and USNRC, 10:11162 (R;DE;In German)
GLASS
See also BOROSILICATE GLASS
PHOSPHATE GLASS
Defects
Computer simulations of rare earth sites in glass: experimental tests and applications to laser materials, 10:11413 (R;US)
Microstructure
Computer simulations of rare earth sites in glass: experimental tests and applications to laser materials, 10:11413 (R;US)
Physical Properties
Properties of glasses with high water content. Final report, June 14, 1979-September 14, 1983, 10:11408 (R;US)
Research and development of laser glasses in China, 10:11501 (J;CN;CH)
Physical Radiation Effects
Research and development of laser glasses in China, 10:11501 (J;CN;CH)

Radiation Effects
Bulk and surface damage thresholds of crystals and glasses at 248 nm, 10:11424 (J;US)

GLAUBER'S SALT
See SODIUM SULFATES

GLUEBALLS
Coupling
Resonances in photon-photon scattering, 10:11842 (R;US)

GLUONIUM
See GLUEBALLS

GLYCOLS
Corrosive Effects
Corrosion resistance of metallic solar absorber materials in a range of heat transfer fluids. Final technical report, 10:11055 (R;US)

GOBAR GAS
See METHANE

GOLD
Catalytic Effects
Characterization of supported metal catalysts by imaging, microdiffraction and microanalysis techniques, 10:11439 (R;US)
Diffusion
Reaction of amorphous NiNb films with crystalline metal overlayers, 10:11350 (R;US)

GOLD ALLOYS
Emission Spectra
Effect of the chemical environment on the L and M heavy-ion-induced x-ray satellite emission spectra, 10:11762 (R;US)
Ion Collisions
Effect of the chemical environment on the L and M heavy-ion-induced x-ray satellite emission spectra, 10:11762 (R;US)
X-Ray Spectra
Effect of the chemical environment on the L and M heavy-ion-induced x-ray satellite emission spectra, 10:11762 (R;US)

GOLD COMPOUNDS
Emission Spectra
Effect of the chemical environment on the L and M heavy-ion-induced x-ray satellite emission spectra, 10:11762 (R;US)
Ion Collisions
Effect of the chemical environment on the L and M heavy-ion-induced x-ray satellite emission spectra, 10:11762 (R;US)
X-Ray Spectra
Effect of the chemical environment on the L and M heavy-ion-induced x-ray satellite emission spectra, 10:11762 (R;US)

GRAIN ALCOHOL
See ETHANOL

GRAMINEAE
See GRASS

GRAND GULF-1 REACTOR
Port Gibson, Mississippi, USA
Reactor Licensing
Technical specifications Grand Gulf Nuclear Station, Unit No. 1 (Docket No. 50-416). Appendix A to License No. NPF-29, 10:11118 (R;US)
Specifications
Technical specifications Grand Gulf Nuclear Station, Unit No. 1 (Docket No. 50-416). Appendix A to License No. NPF-29, 10:11118 (R;US)

GRANITES
See also QUARTZ MONZONITE
Chemical Composition
Expected repository environments in granite: thermal environment, 10:11723 (R;US)
Compression Strength
Expected repository environments in granite: thermal environment, 10:11723 (R;US)
Density
Expected repository environments in granite: thermal environment, 10:11723 (R;US)
Heat Transfer
Expected repository environments in granite: thermal environment, 10:11723 (R;US)
Hydraulic Conductivity
Expected repository environments in granite: thermal environment, 10:11723 (R;US)
Mechanical Properties
Deformation of granitic rocks at elevated temperatures and pressures. Interim report, 1 March-15 December 1984, 10:11724 (R;US)
Permeability
Expected repository environments in granite: thermal environment, 10:11723 (R;US)
Permeability changes during time-dependent deformation of silicate rock, 10:10996 (J;US)
Porosity
Expected repository environments in granite: thermal environment, 10:11723 (R;US)
Shear Properties
Expected repository environments in granite: thermal environment, 10:11723 (R;US)
Specific Heat
Expected repository environments in granite: thermal environment, 10:11723 (R;US)
Tensile Properties
Expected repository environments in granite: thermal environment, 10:11723 (R;US)
Thermal Conductivity
Expected repository environments in granite: thermal environment, 10:11723 (R;US)
Thermal Diffusivity
Expected repository environments in granite: thermal environment, 10:11723 (R;US)
Young Modulus
Expected repository environments in granite: thermal environment, 10:11723 (R;US)

GRANULAR MATERIALS
For unspecified materials having a granular texture.
Flow Models
Granular flow project. Quarterly report, October-December 1984, 10:11477 (R;US)

GRAPHITE
Activation Energy
Electron bombardment enhancement of the reactivity of graphite with atomic hydrogen: Threshold-like effects, 10:11782 (J;US)
Chemical Reactions
Electron bombardment enhancement of the reactivity of graphite with atomic hydrogen: Threshold-like effects, 10:11782 (J;US)
Electron Collisions
Electron bombardment enhancement of the reactivity of graphite with atomic hydrogen: Threshold-like effects, 10:11782 (J;US)
Physical Radiation Effects
Summary of the Rigi-Kaltbad workshop on graphite (Neutrons), 10:11422 (J;NL)

GRAPHITE MODERATOR
See GRAPHITE

GRASS
Productivity
Standing crop and production in annual grass communities in Washington and California: a comparison, 10:11027 (R;US)
Standing crop and production in an undisturbed shrubsteppe community in eastern Washington, 10:11028 (R;US)

GRAVIMELT PROCESS
Bench-Scale Experiments
Bench scale development of the TRW process for cleaning coal (gravimelt process). Quarterly technical progress report, August-October 1984, 10:10842 (R;US)

GRAVITY SURVEYS
Feasibility Studies
Cryogenic gravity gradiometer for geophysical exploration (Airborne), 10:10889 (R;AU)

GROUND SUBSIDENCE
Economic Impact
Economic effects of subsidence from underground coal mining on agricultural land in Illinois. Open file report, 1 September 1982-30 November 1984, 10:10879 (R;US)

GROUND WATER
Chemical Analysis
Geochemical information for sites contaminated with low-level radioactive wastes: II. St. Louis Airport Storage Site, 10:11003 (R;US)
Groundwaier chemistry along flow paths between a proposed repository site and the accessible environment, 10:11000 (R;US)
Chemical Composition
Expected repository environments in granite: thermal environment, 10:11723 (R;US)
Contamination
Influence of landfills on ground-water quality, 10:11632 (R;US)
Organics contamination of groundwater: an open literature review, 10:11633 (R;US)
Corrosive Effects
Test methods to predict long-term corrosion of container materials in repositories, 10:11345 (R;US)
Hydrology
Conceptual model of ground-water flow in the Eastern Kentucky coal field, 10:10904 (RA;US)
Quantitative Chemical Analysis
Effects of coal mining on ground-water quality in West Virginia, 10:10882 (RA;US)
Radionuclide Migration
Characterization and assessment for the Weldon Spring Quarry low-level radioactive waste storage site, 10:10969 (R;US)
Influence of basalt/groundwater interactions on radionuclide migration, 10:10998 (R;US)
Radionuclide migration pathways analysis for the Oak Ridge Central Waste Disposal Facility on the West Chestnut Ridge site, 10:11002 (R;US)
Rock-Fluid Interactions
Influence of basalt/groundwater interactions on radionuclide migration, 10:10998 (R;US)
Sampling
Effects of coal mining on ground-water quality in West Virginia, 10:10882 (RA;US)
Water Quality
Chemical quality of the saturated zone associated with contour surface mining spoil and its effect on stream water quality, 10:10883 (RA;US)
Effects of coal mining on ground-water quality in West Virginia, 10:10882 (RA;US)
GROUND-WATER RESERVES
See AQUIFERS
GRS
See GES FUER REAKTORSICHERHEIT
GUAM
Energy Source Development
Biomass energy options for the American Territories of the Pacific, 10:11223 (R;US)
GUANIDINES
Mutagenesis
Rapid changes in deoxynucleoside triphosphate pools in mammalian cells treated with mutagens, 10:11692 (J;US)
GULF OF ALASKA
Continental Shelf
Proposed Gulf of Alaska/Cook Inlet lease sale 88. Final environmental impact statement. Volume 1, 10:10943 (R;US)
Proposed Gulf of Alaska/Cook Inlet lease sale 88. Final environmental impact statement. Volume 2. Appendices, 10:10944 (R;US)
GYROTRONS
See MICROWAVE AMPLIFIERS

H

H2 REGIONS
Spectra
Imagery and spectroscopy of supernova remnants and H-2 regions, 10:11741 (R;US)
HADRON-HADRON INTERACTIONS
Jet Model
Report of the Snowmass hadronization group, 10:11833 (R;US)
HADRONS
Particle Structure
Diffraction: what do we know; what can we learn, 10:11834 (R;US)
Rest Mass
Monte Carlo calculation of hadron masses with light dynamical quarks, 10:11835 (R;DE)
HANFORD ATOMIC PRODUCTS OPERATION
See HAPO
HANFORD RESERVATION
Birds
Birds of the Hanford site: nest site selection, 10:11626 (R;US)
HAPO
Radioactive Waste Management
Defense waste and byproducts management monthly report, November 1984, 10:10987 (R;US)
Defense waste and byproducts management monthly report, October 1984, 10:10988 (R;US)
Radioactive Waste Processing
Defense waste and byproducts management monthly report, November 1984, 10:10987 (R;US)
Defense waste and byproducts management monthly report, October 1984, 10:10988 (R;US)
Radioactive Waste Storage
Defense waste and byproducts management monthly report, November 1984, 10:10987 (R;US)
Defense waste and byproducts management monthly report, October 1984, 10:10988 (R;US)
HARD SOLDERING
See BRAZING
HASTELLOY N
Mechanical Properties
Tensile and stress rupture tests of S8DR Hastelloy-N heats: ORNL verification tests, 10:11344 (R;US)
Physical Radiation Effects
Electron microprobe analysis of irradiated S8ER cladding, 10:11114 (R;US)
HAZARDOUS MATERIALS
Not for radioactive materials.
Environmental Transport
Mobility of toxic compounds from hazardous wastes. Report for January 1982-December 1983, 10:11190 (R;US)
HCDA
See REACTOR CORE DISRUPTION
HD 8077
See NICKEL BASE ALLOYS
HDO
See HEAVY WATER
HEAT DISSIPATION
See DIFFUSION
ENVIRONMENTAL TRANSPORT
HEAT TRANSFER
HEAT EXCHANGERS
Design
The state-of-the-art in understanding and solving flow induced vibration problems in shell-and-tube heat exchangers, 10:11526 (BA;US)
Mechanical Vibrations
The state-of-the-art in understanding and solving flow induced vibration problems in shell-and-tube heat exchangers, 10:11526 (BA;US)
HEAT RESISTING ALLOYS
See also STAINLESS STEEL-304
STAINLESS STEEL-316
STEEL-DIN-1-4981
Joining
Use of electrodeposition to provide coatings for solid state bonding, 10:11384 (J;US)
HEAT STORAGE
Solutions
Feasibility study of binary solutions for thermal energy storage in high and low temperature applications, 10:11177 (R;US)
HEAT STORAGE DEVICES
See THERMAL ENERGY STORAGE EQUIPMENT

HEAT STORAGE SYSTEMS
See THERMAL ENERGY STORAGE EQUIPMENT
HEAT TRANSFER
Boltzmann Equation
H-Division materials physics quarterly report, April-June 1984, 10:11323 (R;US)
Measuring Methods
Correlation of local heat flux from inclined volume-heated pools in bubbly flow, 10:11512 (J;US)
HEAT TRANSFER FLUIDS
Corrosive Effects
Corrosion resistance of metallic solar absorber materials in a range of heat transfer fluids. Final technical report, 10:11055 (R;US)
HEAT TRANSMISSION
See HEAT TRANSFER
HEAVY FUELS
See RESIDUAL FUELS
HEAVY ION REACTIONS
See also ARGON 40 REACTIONS
CALCIUM 40 REACTIONS
DEEP INELASTIC HEAVY ION REACTIONS
KRYPTON 86 REACTIONS
MOLYBDENUM 92 REACTIONS
OXYGEN 16 REACTIONS
SILICON 28 REACTIONS
Bibliographies
Heavy-Ion Reactions: a current awareness bulletin, 10:11863 (R;US)
Experiment Planning
Report on the 1984 LBL workshop on detectors for relativistic nuclear collisions, 10:11550 (R;US)
Nuclear Theory
Progress in research, November 1, 1983-October 31, 1984, 10:11887 (R;US)
Quark Matter
Probes of the quark-gluon plasma as it might be produced in ultra-relativistic nuclear collisions, 10:11889 (R;US)
Space station as quark matter factory, 10:11877 (R;US)
Radiation Detectors
Report on the 1984 LBL workshop on detectors for relativistic nuclear collisions, 10:11550 (R;US)
Research Programs
Experiments on the TASS and HISS spectrometers at the Bevalac. Annual progress report, April 1, 1984-March 31, 1985, 10:11875 (R;US)
Self-Consistent Field
Mean-field dynamics versus two-body collisions at intermediate energy heavy-ion reactions, 10:11890 (R;DE)
HEAVY NUCLEI
For nuclei from mass 181 upwards.
See also ACTINIDE NUCLEI
RADON 220
RADON 222
Alpha Decay
Discovery of element 108 - the island of α-active nuclei beyond element 105, 10:11884 (R;DE)
Collective Excitations
Low-lying isovector excitations in heavy nuclei, 10:11879 (R;US)
Interacting Boson Model
Low-lying isovector excitations in heavy nuclei, 10:11879 (R;US)
Nucleon-Nucleon Interactions
Low-lying isovector excitations in heavy nuclei, 10:11879 (R;US)
HEAVY OILS
See PETROLEUM
HEAVY WATER
Purification
Simulation calculations for a catalytic exchange/cryogenic distillation hydrogen isotope separation process, 10:11137 (R;US)
HEAVY WATER COOLANT
See HEAVY WATER
HEAVY WATER COOLED REACTORS
See also PHWR TYPE REACTORS
Fuel Assemblies
Quality control considerations in fuel assembly fabrication for natural uranium reactors, 10:11109 (RA;DE;In French)
HEAVY WATER MODERATED REACTORS
See also PHWR TYPE REACTORS
Coolant Cleanup Systems
Simulation calculations for a catalytic exchange/cryogenic distillation hydrogen isotope separation process, 10:11137 (R;US)
HEAVY WATER MODERATOR
See HEAVY WATER
HEAVY WATER PLANTS
Materials
Effect of neutralization on protectiveness of sulfide films on carbon steel, 10:11007 (J;US)
HELIOTRON
Charged-Particle Transport
Transport of injected impurities in Heliotron E, 10:11959 (J;AT)
Impurities
Transport of injected impurities in Heliotron E, 10:11959 (J;AT)
HELIUM
Atom-Molecule Collisions
State-to-state vibrational excitation of I_2 in collisions with He, 10:11790 (J;US)
Ion-Atom Collisions
Resonant electron transfer and excitation in two, three, and four electron sub20Casupq+ and sub23Vsupq+ ions colliding with helium, 10:11781 (J;US)
HELIUM 3 REACTIONS
Knock-Out Reactions
Nuclear reaction n + ^{3}He -> ^{1}H + ^{3}H as proximity reaction, 10:11869 (R;DE;In German)
HELIUM 3 TARGET
Neutron Reactions
Nuclear reaction n + ^{3}He -> ^{1}H + ^{3}H as proximity reaction, 10:11869 (R;DE;In German)
HELIUM IONS
Electric Charges
Charge-state composition of 0.4-MeV helium ions in earth's outer radiation belts during quiet times. Technical report, 10:11734 (R;US)
HEMOGLOBIN
Mutations
Analysis of a mouse α-globin gene mutation induced by ethylnitrosourea, 10:11691 (J;US)
HEPATOCYTES
See LIVER CELLS
HERMITIAN MATRIX
Algorithms
Modified Method for Reconstructing periodic Jacobi matrices, 10:12022 (J;US)
HETEROCYCLIC COMPOUNDS
See also FURANS
POLYCYCLIC SULFUR HETEROCYCLES
PSORALEN
THIOPHENE
TMTSF
TTF
Mutagen Screening
Microbial mutagenicity of 3- and 4-ring polycyclic aromatic sulfur heterocycles (Salmonella typhimurium), 10:11702 (J;NL)
HFR REACTOR
Fuel Cycle
Neutronics study of LEU fuel options for the HFR-Petten, 10:11133 (R;US)
Slightly Enriched Uranium
Neutronics study of LEU fuel options for the HFR-Petten, 10:11133 (R;US)
HHIRF
Data Processing
CHIL - a comprehensive histogramming language, 10:12009 (R;US)

Magnetic Spectrometers
New focal plane detector system for the broad range spectrometer, 10:11541 (R;US)
Targets
Nuclear physics experiments with the ORNL-HHIRF supersonic gas jet target, 10:11868 (R;US)
HIGH ALTITUDE (STRATOSPHERE)
See STRATOSPHERE
HIGH ENERGY PHYSICS
Use only for articles of a very broad nature such as an annual research program, etc.
Meetings
Gauge theories, massive neutrinos, and proton decay, 10:11812 (B;US)
Particles and fields - 1983, 10:11811 (B;US)
Research Programs
Activities in nuclear and high energy physics, 10:11826 (R;NL;In Dutch)
Experimental studies of elementary particle interactions at high energies. Technical progress report, 10:11822 (R;US)
Research in theoretical elementary particle physics. Annual progress report, 10:11838 (R;US)
Summaries of FY 1984 research in high energy physics, 10:11809 (R;US)
Technical progress report, November 1, 1983-October 31, 1984, 10:11839 (R;US)
HIGH ENERGY RADIOTHERAPY
See RADIOTHERAPY
HIGH EXPLOSIVES
See CHEMICAL EXPLOSIVES
HIGH FLUX REACTOR PETTEN
See HFR REACTOR
HIGH TEMPERATURE GAS COOLED AND GRAPHITE
See HTGR TYPE REACTORS
HIGH-LEVEL RADIOACTIVE WASTES
Emplacement
Preliminary requirements for the emplacement and retrieval of defense high-level waste (DHLW) tests in the Waste Isolation Pilot Plant (WIPP), 10:10990 (R;US)
Radioactive Waste Disposal
Lead-iron phosphate glass: a stable storage medium for high-level nuclear waste, 10:10995 (J;US)
Radioactive Waste Processing
Description of the plant for solidification of fission products: PAMELA (PAMELA), 10:10994 (TG;US)
Retrieval Systems
Preliminary requirements for the emplacement and retrieval of defense high-level waste (DHLW) tests in the Waste Isolation Pilot Plant (WIPP), 10:10990 (R;US)
Vitrification
Description of the plant for solidification of fission products: PAMELA (PAMELA), 10:10994 (TG;US)
HIGH-TEMPERATURE FUEL CELLS
See also MOLTEN CARBONATE FUEL CELLS
Design
Advancing from single cell technology to generator engineering: A SOFC status report, 10:11246 (RA;US)
Monolithic fuel cells, 10:11245 (RA;US)
Monolithic fuel cells, 10:11226 (R;US)
Performance
Advancing from single cell technology to generator engineering: A SOFC status report, 10:11246 (RA;US)
Performance characteristics of solid oxide fuel cells, 10:11255 (RA;US)
Performance Testing
Development of high temperature solid electrolyte fuel cell at electrotechnical laboratory, 10:11270 (RA;US)
Research Programs
Solid oxide fuel cells, 10:11230 (RA;US)
HIGHWAYS
See ROADS
HOLIFIELD HEAVY ION RESEARCH FACILITY
See HHIRF
HOLMIUM 161
Energy Levels
Nuclear data sheets for A = 161, 10:11880 (J;US)
Energy-Level Transitions
Nuclear data sheets for A = 161, 10:11880 (J;US)
HOMOGENEOUS PLASMA
Nonlinear Problems
Simulation of phase space hole growth and the development of intermittent plasma turbulence, 10:11951 (J;US)
Turbulence
Simulation of phase space hole growth and the development of intermittent plasma turbulence, 10:11951 (J;US)
HOSPITALS
Design
Energy to recover, 10:11296 (J;US)
Energy Conservation
Energy to recover, 10:11296 (J;US)
HOT CELLS
Decontamination
Remote removal of contaminated equipment from a radiochemical engineering cell, 10:10985 (R;US)
HOT GAS CLEANUP
Technology Assessment
Evaluation of particulate collection devices developed for pressurized fluidized-bed combustors as applied to coal gasification processes, 10:10867 (R;US)
HOT LABS
Criticality
Criticality safety training at the Hot Fuel Examination Facility, 10:11482 (R;US)
HOUSEHOLDS
Energy Consumption
Three years after participation: electricity savings due to the BPA Residential Weatherization Pilot Program, 10:11292 (R;US)
HOUSES
Thermal Insulation
Comparison of manufactured-housing thermal characteristics, 10:11294 (R;US)
HTGR TYPE REACTORS
Fission Product Release
Analysis of fission product transport parameters in the fuel element for temperatures up to 2500°C based on heat-up experiments and their application to heat-up incidents using the PNP-500 as example, 10:11130 (R;DE;In German)
Fuel Elements
Analysis of fission product transport parameters in the fuel element for temperatures up to 2500°C based on heat-up experiments and their application to heat-up incidents using the PNP-500 as example, 10:11130 (R;DE;In German)
Reactor Safety
Analysis of fission product transport parameters in the fuel element for temperatures up to 2500°C based on heat-up experiments and their application to heat-up incidents using the PNP-500 as example, 10:11130 (R;DE;In German)
Spent Fuel Storage
Storage characteristics of spent HTR fuel elements in transport and storage containers of modular cast iron, 10:11108 (R;DE;In German)
HTO
See HEAVY WATER
HUGENHOLTZ-PINES THEORY
See HYDROGEN
HUMAN CELLS
See ANIMAL CELLS
HUMAN FACTORS ENGINEERING
Decision Making
Regulatory analyses for severe accident issues: an example, 10:11170 (R;US)
HUMAN POPULATIONS
See also MINORITY GROUPS
Genetic Radiation Effects
Alternative interpretations of statistics on health effects of low-level radiation, 10:11682 (J;US)
Preventive Medicine
How dangerous are routine X-ray checkups, 10:11657 (R;DE;In German)
Radiation Hazards
How dangerous are routine X-ray checkups, 10:11657 (R;DE;In German)

HUMANS
See HUMAN POPULATIONS
HUMIC ACIDS
Gas Chromatography
Identification of lignosulfonic acid and humic acid by pyrolysis, gas chromatography and mass spectrometry (Py-GC-MS), 10:11437 (TG;US)
Mass Spectroscopy
Identification of lignosulfonic acid and humic acid by pyrolysis, gas chromatography and mass spectrometry (Py-GC-MS), 10:11437 (TG;US)
Pyrolysis
Identification of lignosulfonic acid and humic acid by pyrolysis, gas chromatography and mass spectrometry (Py-GC-MS), 10:11437 (TG;US)
HYDRATED ELECTRONS
See SOLVATED ELECTRONS
HYDRAULIC FRACTURES
Geometry
Proppant transport model. Final report, 10:10950 (R;US)
HYDRAULIC FRACTURING
Mathematical Models
Proppant transport model. Final report, 10:10950 (R;US)
Propping Agents
Proppant transport model. Final report, 10:10950 (R;US)
HYDRAULIC RAMS
See PUMPS
HYDROCYCLONES
See CYCLONE SEPARATORS
HYDROELECTRIC POWER
Research Programs
Appropriate Technology Small Grants Program. Code case studies, 10:11222 (R;US)
HYDROELECTRICITY
See HYDROELECTRIC POWER
HYDROGEN
Chemical Reaction Kinetics
Improved potential energy surface for $F+H_2 \rightarrow HF+H$ and $H+H'F \rightarrow HF+H'$, 10:11447 (J;US)
Chemical Reactions
Electron bombardment enhancement of the reactivity of graphite with atomic hydrogen: Threshold-like effects, 10:11782 (J;US)
Chemisorption
Hydrogen chemisorption on transition metal clusters, 10:11449 (J;US)
Diffusion
Diffusion of deuterium and hydrogen in rutile TiO_2 crystals at low temperatures, 10:11398 (J;US)
Effective monatomic hydrogen diffusion constants in polycrystalline silicon, 10:11032 (RA;US)
Ion-Molecule Collisions
Study of the symmetric charge transfer reaction $H^+{}_2+H_2$ using the high resolution photoionization and crossed ion—neutral beam methods, 10:11791 (J;US)
Losses
Effect of water on hydrogen permeability, 10:11317 (R;US)
Oscillator Strengths
H-Division materials physics quarterly report, April-June 1984, 10:11323 (R;US)
HYDROGEN 1 TARGET
Electron Reactions
Theoretical nuclear reaction and structure studies using kaons and photons. Progress report, 10:11866 (R;US)
HYDROGEN 2
See DEUTERIUM
HYDROGEN 3
See TRITIUM
HYDROGEN FUEL CELLS
Economic Analysis
Fuel cell power system for forklift trucks, 10:11258 (RA;US)
Performance
OXY hydrogen-air fuel cell, 10:11254 (RA;US)
Status of solid polymer electrolyte fuel cell technology, 10:11260 (RA;US)
Research Programs
Small methanol powerplant progress, 10:11257 (RA;US)
Uses
OXY hydrogen-air fuel cell, 10:11254 (RA;US)
HYDROGEN HYDROXIDES
See WATER
HYDROGEN IONS 1 PLUS
For H_1^+ ions.
Ion-Molecule Collisions
Study of the symmetric charge transfer reaction $H^+{}_2+H_2$ using the high resolution photoionization and crossed ion—neutral beam methods, 10:11791 (J;US)
HYDROGEN PEROXIDE
Commercial scale demonstration enhanced oil recovery by micellar-polymer flood. Technical progress report, November 1984, 10:10936 (R;US)
HYDROGEN PRODUCTION
Economics
Economics of hydrogen production, 10:11010 (R;US)
HYDROGEN SULFIDES
Structure-sensitive catalytic dehydrogenation of hydrogen donor over iron sulfides: new methods for increasing coal depolymerization under mild conditions, 10:11443 (RA;US)
Adsorption
Electron energy loss spectroscopy of H_2S adsorbed on Ni(100), 10:11451 (J;US)
Decomposition
Electron energy loss spectroscopy of H_2S adsorbed on Ni(100), 10:11451 (J;US)
HYDROGENATION
Catalysts
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 1, October-December 1983, 10:11458 (R;US)
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 4, July-September 1984, 10:11459 (R;US)
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 3, April-June 1984, 10:11460 (R;US)
Regeneration of catalysts for use in continuous flow coal hydrogenation, 10:10847 (R;AU)
HYDROXYBENZENE
See PHENOL
HYLIFE CONVERTER
High Yield Lithium Injection Fusion Energy Converter.
Research Programs
Inertial fusion reactor studies at Lawrence Livermore National Laoratory, 10:11998 (BA;GB)

I

I-BEAM TYPE REACTORS
Closed-Cycle Systems
Inertial confinement fusion concepts for advanced fuels, 10:11997 (BA;GB)
Research Programs
Inertial fusion reactor studies at Lawrence Livermore National Laoratory, 10:11998 (BA;GB)
Thermonuclear Explosions
Equilibrium and non-equilibrium microfireball behaviour in light-ion fusion systems, 10:11986 (J;AT)
Tritium Recovery
Inertial confinement fusion concepts for advanced fuels, 10:11997 (BA;GB)
ICE
Thawing
Variation of Arctic cloud cover in summer, 10:11586 (R;US)
ICR HEATING
Monte Carlo Method
Monte-Carlo study of ICRF-sustained mode operation in tandem mirrors, 10:11957 (J;AT)

IDAHO CHEMICAL PROCESSING PLANT
Mechanical Filters
Decontamination and decommissioning of CPP-603 BIF filter room. Final report, 10:10993 (R;US)
IDAHO NATIONAL ENGINEERING LABORATORY
Prior to 1976 known as NRTS and older material is so indexed.
Computer Networks
INEL User Network Exchange. Volume 1-85, Jan./Feb. 1985, 10:12011 (R;US)
IDENTIFICATION SYSTEMS
Bar code instrumentation for nuclear safeguards, 10:11004 (R;US)
IEUS
Acid Electrolyte Fuel Cells
Integrated energy systems for buildings, 10:11231 (RA;US)
IGNITION (THERMONUCLEAR)
See THERMONUCLEAR IGNITION
ILLINOIS
Coal Mines
Evaluation of existing data on discharges from active coal mines in Illinois, 10:10884 (RA;US)
ILLUMINATION SYSTEMS
See LIGHTING SYSTEMS
IMAGE PROCESSING
Fourier Transformation
Image formation in terms of the transport equation, 10:11918 (R;US)
IMAGE TUBES
Photoelectrochemical Cells
Photoelectrochemical imaging, 10:11577 (J;US)
IMAGES
Readout Systems
Fast readout of CCD images, 10:11517 (R;US)
IMINOUREA
See GUANIDINES
INCINERATION
See COMBUSTION
INCOLOY 800
Corrosion Resistance
Evaluation of alternative alloys for PWR steam generator tubing. Final report, 10:11096 (R;US)
INCONEL 600
Corrosion Resistance
Evaluation of alternative alloys for PWR steam generator tubing. Final report, 10:11096 (R;US)
Intergranular Corrosion
Mechanisms of stress corrosion cracking and intergranular attack in Alloy 600 in high temperature caustic and pure water, 10:11327 (R;US)
Stress Corrosion
Mechanisms of stress corrosion cracking and intergranular attack in Alloy 600 in high temperature caustic and pure water, 10:11327 (R;US)
INCONEL 625
Corrosion Resistance
Re-heating flue gases from flue gas cleaning plants by means of heat exchangers, 10:10876 (TJ;GB)
INCONEL 690
Corrosion Resistance
Evaluation of alternative alloys for PWR steam generator tubing. Final report, 10:11096 (R;US)
INDOLES
Hydrogenation
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 1, October-December 1983, 10:11458 (R;US)
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 3, April-June 1984, 10:11460 (R;US)
INDONESIA
Energy Policy
Indonesian oil and gas, 10:11216 (R;US)
Natural Gas
Indonesian oil and gas, 10:11216 (R;US)
Petroleum
Indonesian oil and gas, 10:11216 (R;US)
INDOOR AIR POLLUTION
Tennessee Valley Authority/Bonneville Power Administration Indoor Air Quality Study. Volume II, 10:11595 (R;US)
INDUCTION FURNACES
Heat Recovery
Possibilities of heat recovery in induction heating and melting, 10:11313 (TG;GB)
INDUSTRIAL PLANTS
See also COAL GASIFICATION PLANTS
COAL LIQUEFACTION PLANTS
COAL PREPARATION PLANTS
PETROLEUM REFINERIES
Energy Conservation
Energy efficiency in electrical power generation and industrial sectors, 10:11307 (RA;US)
Industrial energy management, 10:11304 (RA;US)
Industrial energy conservation in Morocco and Senegal, 10:11305 (RA;US)
Introduction and background, 10:11282 (RA;US)
Overview study to identify the potential contribution of technologies to energy conservation in Australian industry, 10:11215 (R;AU)
Energy Management
Industrial energy management, 10:11304 (RA;US)
Fuel Substitution
Overview study to identify the potential contribution of technologies to energy conservation in Australian industry, 10:11215 (R;AU)
INDUSTRIAL SECTOR
See INDUSTRY
INDUSTRIAL WASTES
Waste Disposal
Mobility of toxic compounds from hazardous wastes. Report for January 1982-December 1983, 10:11190 (R;US)
INDUSTRY
See also AUTOMOTIVE INDUSTRY
CHEMICAL INDUSTRY
COAL INDUSTRY
ELECTRIC POWER INDUSTRY
METAL INDUSTRY
PETROLEUM INDUSTRY
Acid Electrolyte Fuel Cells
Development of PAFC system and its application to industrial use, 10:11253 (RA;US)
Energy Efficiency
Industrial energy efficiency reporting: a bridge to information transfer, 10:11211 (BA;CA)
Information Needs
Corporate use of information regarding natural resources and environmental quality, 10:11186 (R;US)
INERTIAL CONFINEMENT
A dynamic plasma confinement by inertial forces.
Laser Radiation
Laser-beam cleaning in a plasma compressor, 10:11984 (J;US)
INFORMATION CENTERS
Cost Benefit Analysis
Value of the National Energy Software Center and the Radiation Shielding Information Center. Volume 2, 10:12028 (RA;US)
Evaluation
Study of the value of information and the effect on value of intermediary organizations, timeliness of services and products, and comprehensiveness of the EDB. Volume 1, Volume 2, and Volume 3, 10:12026 (R;US)
INFORMATION DISSEMINATION
Cost Benefit Analysis
Value of libraries as an intermediary information service. Volume 1, 10:12027 (RA;US)
INFORMATION SYSTEMS
Government acronyms and alphabetic organizational designations used in DTIC (Defense Technical Information Center), 10:12030 (R;US)
Evaluation
Effect of timeliness and comprehensiveness on value. Volume 3, 10:12029 (RA;US)
Study of the value of information and the effect on value of intermediary organizations, timeliness of services and

products, and comprehensiveness of the EDB. Volume 1, Volume 2, and Volume 3, 10:12026 (R;US)

INFORMATION VALIDATION
Automation
Automated data qualification, 10:11147 (R;US)

INHIBITORS (ENZYME)
See ENZYME INHIBITORS

IN-SITU GASIFICATION
Bibliographies
In-situ coal gasification: a bibliography (2222 references), 10:10844 (R;US)

IN-SITU RETORTING
Environmental Impacts
BX In Situ Oil Shale Project. Environmental Mitigation and Monitoring Plan (revised September 1981), 10:10955 (R;US)
Pollution Control
BX In Situ Oil Shale Project. Environmental Mitigation and Monitoring Plan (revised September 1981), 10:10955 (R;US)

INSTITUTE FOR REACTOR SAFETY
See GES FUER REAKTORSICHERHEIT

INSTITUTIONAL SECTOR
Energy Conservation
The institutional Conservation Program: a success story, 10:11212 (BA;CA)
Energy Management
The institutional Conservation Program: a success story, 10:11212 (BA;CA)

INSULATION (ELECTRICAL)
See ELECTRICAL INSULATION

INTEGRATED CIRCUITS
Fabrication
High sheet resistance, arsenic implanted polycrystalline silicon for integrated circuit resistors, 10:11519 (R;US)
Meetings
Physics of VLSI, 10:11522 (B;US)

INTEGRATED ENERGY UTILITY SYSTEMS
See IEUS

INTERACTING BOSON MODEL
Collective Excitations
Low-lying isovector excitations in heavy nuclei, 10:11879 (R;US)
Supersymmetry
Nuclear dynamical supersymmetry, 10:11895 (J;US)

INTERCHANGE INSTABILITY
See FLUTE INSTABILITY

INTERCONNECTED POWER SYSTEMS
Electrical Equipment
Coordinated decentralized emergency operating state control, 10:11065 (R;US)
Emergency Plans
Coordinated decentralized emergency operating state control, 10:11065 (R;US)

INTERMEDIATE BOSONS
Radiative Decay
Constraints on radiative Z_0 decays, 10:11849 (J;US)

INTERMETALLIC COMPOUNDS
Magnetic Properties
Magnetic studies of $Ni_3Al(Fe)$ compounds, 10:11330 (R;US)
Structural Chemical Analysis
Synthesis and characterization of tetranuclear molybdenum iodide clusters, 10:11444 (R;US)
Synthesis
Synthesis and characterization of tetranuclear molybdenum iodide clusters, 10:11444 (R;US)
Synthesis and reactivity of heterodinuclear iron, ruthenium, and cobalt compounds containing bridging dithiomethylene ligands. Attempted synthesis of the iron carbyne compound $Cp(CO)FeCSCH_3$, 10:11461 (R;US)

INVERSE SCATTERING PROBLEM
Differential Equations
Electromagnetic inverse problem for dispersive media, 10:11861 (J;US)

IODINE
Adsorption
Characterization of soils at proposed Solid Waste Storage Area (SWSA) 7, 10:11625 (R;US)
Atom-Molecule Collisions
State-to-state vibrational excitation of I_2 in collisions with He, 10:11790 (J;US)

IODINE IODIDES
See IODINE

ION BEAM TYPE REACTORS
See I-BEAM TYPE REACTORS

ION CLUSTERS
See ION PAIRS

ION COLLISIONS
See also ION-ATOM COLLISIONS
ION-MOLECULE COLLISIONS
X-Ray Spectra
Ultrahigh-resolution studies of heavy-ion-induced x-ray satellite emission, 10:11763 (R;US)

ION CYCLOTRON-RESONANCE HEATING
See ICR HEATING

ION EXCHANGE CHROMATOGRAPHY
Reagents
Selectivity variations in anion chromatography, 10:11428 (R;US)

ION EXCHANGE MEMBRANES
See MEMBRANES

ION IMPLANTATION
Uses
Ion implantation metallurgy, 10:11364 (J;US)

ION PAIRS
Thermodynamic Properties
Neutral and charged clusters in the atmosphere: their importance and potential role in heterogeneous catalysis, 10:11455 (J;US)

ION PLASMA WAVES
Dispersive ion waves
Bernstein Mode
Observation of the backward electrostatic ion cyclotron wave, 10:11946 (R;US)
Parasitic excitation of ion Bernstein waves from a Faraday shielded fast wave loop antenna, 10:11945 (R;US)
Excitation
Parasitic excitation of ion Bernstein waves from a Faraday shielded fast wave loop antenna, 10:11945 (R;US)

ION SOURCES
Electric Discharges
Intense beams of mass-separated, neutron-deficient indium, tin and lead isotopes, 10:11547 (R;DE)
Performance
Thermal ion source for quadrupole mass spectrometers, 10:11579 (J;NL)

ION-ATOM COLLISIONS
Cross Sections
Resonant electron transfer and excitation in two, three, and four electron sub20Casupq+ and sub23Vsupq+ ions colliding with helium, 10:11781 (J;US)
Electron Transfer
Resonant electron transfer and excitation in two, three, and four electron sub20Casupq+ and sub23Vsupq+ ions colliding with helium, 10:11781 (J;US)
Photon Emission
Resonant electron transfer and excitation in two, three, and four electron sub20Casupq+ and sub23Vsupq+ ions colliding with helium, 10:11781 (J;US)
Reviews
Positron spectroscopy of supercritical heavy ion collision systems, 10:11767 (R;DE)

IONIC REACTIONS
See IONS

IONIZATION CALORIMETERS
See SHOWER COUNTERS

ION-MOLECULE COLLISIONS
Energy Losses
Mean delta-ray energies in ion-molecule collisions, 10:11900 (R;US)

IONOSPHERE
Ring Currents
Region 1 Birkeland currents from a global MHD simulation of the magnetosphere. Memorandum report, October 1984-October 1985, 10:11733 (R;US)
IONS
Ions in solutions are indexed as compounds; ions in gases by the precoordinated descriptor consisting of the element name and the term ions; ions in beams by assigning either the specific name if available, e.g. ARGON 40 BEAMS
See also ARGON IONS
BROMINE IONS
CALCIUM IONS
CHLORINE IONS
HELIUM IONS
MULTICHARGED IONS
URANIUM IONS
VANADIUM IONS
XENON IONS
Collective Accelerators
Space-charge wave propagation in inhomogeneous waveguides, 10:11535 (J;US)
IRON
Corrosion
Initiation of single corrosion sites on iron by focused laser illumination, 10:11372 (J;GB)
Dissolution
Mechanism and kinetics of iron electrode dissolution in KOH electrolytes, 10:11179 (R;US)
Magnetic Susceptibility
New scalar potential formulation of the magnetostatic field problem, 10:11924 (J;US)
Physical Radiation Effects
Initiation of single corrosion sites on iron by focused laser illumination, 10:11372 (J;GB)
IRON ALLOYS
See also INCONEL 600
INCONEL 625
Ductility
Ductile ordered intermetallic alloys, 10:11363 (J;US)
Fabrication
Ductile ordered intermetallic alloys, 10:11363 (J;US)
Magnetic Properties
Magnetic studies of $Ni_3Al(Fe)$ compounds, 10:11330 (R;US)
Oxidation
Isotope studies of Fe-18Cr-3Mo (100) oxidation using Raman spectroscopy, 10:11351 (R;US)
IRON COMPLEXES
Chemical Reactions
Synthesis and reactivity of heterodinuclear iron, ruthenium, and cobalt compounds containing bridging dithiomethylene ligands. Attempted synthesis of the iron carbyne compound $Cp(CO)FeCSCH_3$, 10:11461 (R;US)
Structural Chemical Analysis
Synthesis and reactivity of heterodinuclear iron, ruthenium, and cobalt compounds containing bridging dithiomethylene ligands. Attempted synthesis of the iron carbyne compound $Cp(CO)FeCSCH_3$, 10:11461 (R;US)
Synthesis
Synthesis and reactivity of heterodinuclear iron, ruthenium, and cobalt compounds containing bridging dithiomethylene ligands. Attempted synthesis of the iron carbyne compound $Cp(CO)FeCSCH_3$, 10:11461 (R;US)
IRON COMPOUNDS
See also IRON OXIDES
IRON SILICIDES
IRON SULFIDES
Ion Exchange
Studies of cation exchange for the isolation and concentration of trace level components of complex aqueous mixtures, 10:10974 (R;US)
Synthesis
Synthesis and reactivity of heterodinuclear iron, ruthenium, and cobalt compounds containing bridging dithiomethylene ligands. Attempted synthesis of the iron carbyne compound $Cp(CO)FeCSCH_3$, 10:11461 (R;US)
IRON OXIDES
See also MAGNETITE
Atmospheric Chemistry
Application of quantum chemistry of atmospheric chemistry. Annual report, 1 October 1983-30 September 1984, 10:11438 (R;US)
Materials Recovery
Potential resources from coal fly ash, 10:10863 (R;US)
IRON SILICIDES
Josephson Effect
Josephson effect in $Lu_2Fe_3Si_5$: Evidence against triplet pairing, 10:11420 (J;US)
IRON SULFIDES
See also PYRITE
Catalytic Effects
Structure-sensitive catalytic dehydrogenation of hydrogen donor over iron sulfides: new methods for increasing coal depolymerization under mild conditions, 10:11443 (RA;US)
Ion Collisions
Ultrahigh-resolution studies of heavy-ion-induced x-ray satellite emission, 10:11763 (R;US)
ISX TOKAMAK
Energy Losses
Measurement of chisub(e) in ISX-B beam-heated discharges by heat pulse propagation, 10:11965 (J;AT)
Thermal Diffusivity
Measurement of chisub(e) in ISX-B beam-heated discharges by heat pulse propagation, 10:11965 (J;AT)

J

JAPAN
Fuel Cell Power Plants
Applications of fuel cell power plants in Japanese utility use, 10:11272 (RA;US)
JEMEZ MOUNTAINS
Drainage
Observations of a drainage flow event on a high-altitude simple slope, 10:11587 (J;US)
JET ENGINE FUELS
Sales
Petroleum Marketing Monthly, October 1984, 10:10941 (R;US)
JET MODEL
Report of the Snowmass hadronization group, 10:11833 (R;US)
Comparative Evaluations
Comparison of quark and gluon jets, 10:11837 (R;DE)
JET REACTORS
Neutron Spectra
Absolute fission chambers for high-energy neutron fields. Final report, 10:11941 (R;US)
Plasma Diagnostics
Proposed 14-MeV neutron spectrometer system for jet, 10:11947 (R;SE)
JETS
Aerodynamics
Aerodynamics of burner jets designed for brown coal fired boilers, 10:10929 (R;AU)
JOINTS (ANATOMY)
See BONE JOINTS
JOSEPHSON JUNCTIONS
Tunnel Effect
Macroscopic quantum tunnelling in a current biased Josephson junction, 10:11914 (R;US)
JOURNAL BEARINGS
Computer-Aided Design
BEARING and BPLOT: two programs for designing full (360-degree) journal bearings, 10:11479 (R;US)

K

K-25 PLANT
See ORGDP
KALKAR POWER REACTOR
See SNR-1 REACTOR
KANSAS
Oil Fields
Volume and area of oil fields and their impact on order of discovery, 10:10934 (R;US)
KAONS PLUS
Electroproduction
Theoretical nuclear reaction and structure studies using kaons and photons. Progress report, 10:11866 (R;US)
KARLSRUHE NUCLEAR RESEARCH CENTER
See KERNFORSCHUNGSZENTRUM KARLSRUHE
KEPONE
Chemical Radiation Effects
Beneficial uses of nuclear byproducts/Sewage Sludge Irradiation Project. Progress report, January-June 1983, 10:11008 (R;US)
KERNFORSCHUNGSZENTRUM KARLSRUHE
Meteorology
Experimental determination of the atmospheric dispersion parameters at the Karlsruhe Nuclear Research Center for 160 m and 195 m emission heights. Pt. 2, 10:11610 (R;DE)
KRYPTON
Viscosity
Viscosity of carbon-monoxide mixtures with four gases in the temperature range 25-200°C: supplement, 10:11465 (J;DE)
KRYPTON 86 REACTIONS
Deep Inelastic Heavy Ion Reactions
Quantum interference and statistical fluctuations in deep inelastic heavy-ion reactions, 10:11891 (R;DE)

L

LABORATORY EQUIPMENT
See also HOT CELLS
Fabrication
Simple, inexpensive apparatus for rotating bottles during zooplankton feeding experiments, 10:11629 (J;NL)
LACTATE DEHYDROGENASE
Chemical Radiation Effects
Studies on irradiated lactate dehydrogenase using gel electrophoresis, 10:11674 (R;DE;In German)
LAMPF LINAC
Brazing
Standard operating procedure, gas atmosphere brazing facility/LAMPF Equipment Test Laboratory, 10:11485 (R;US)
LAND FILLS
See SANITARY LANDFILLS
LAND RECLAMATION
Erosion
Erosion characteristics of surface-mined soils, 10:10885 (RA;US)
Revegetation
Shrub cover and density on western rangelands in relation to reclamation standards for surface mined lands in Wyoming, 10:10873 (RA;US)
LAND USE
Regulations
Selective permit requirements for natural resource development, land use regulation, environmental quality management, social/ecological preservation, and local regulatory policy. Volume 4. Vermont, 10:11627 (R;US)
LANDFILLS
See SANITARY LANDFILLS
LANGMUIR OSCILLATIONS
See PLASMA WAVES
LANTHANIDES
See RARE EARTHS
LANTHANUM ALLOYS
Electric Conductivity
Phase stability and magnetic properties of UAl_2 based pseudobinary spin fluctuation compounds, 10:11341 (R;US)
Magnetic Susceptibility
Phase stability and magnetic properties of UAl_2 based pseudobinary spin fluctuation compounds, 10:11341 (R;US)
Phase Stability
Phase stability and magnetic properties of UAl_2 based pseudobinary spin fluctuation compounds, 10:11341 (R;US)
Specific Heat
Phase stability and magnetic properties of UAl_2 based pseudobinary spin fluctuation compounds, 10:11341 (R;US)
LANTHANUM CHROMITES
See CHROMIUM OXIDES
LANTHANUM OXIDES
LANTHANUM OXIDES
Binding Energy
Properties of lanthanide oxides as supports for transition metal catalysts. Progress report, May 1, 1984-April 30, 1985, 10:11441 (R;US)
LASER MATERIALS
Glass
Research and development of laser glasses in China, 10:11501 (J;CN;CH)
LASER RADIATION
Coupling
Photoelectron motion in the presence of a probe electromagnetic wave, 10:11794 (J;US)
Focusing
Laser-beam cleaning in a plasma compressor, 10:11984 (J;US)
Two-dimensional Lasnex ray-trace calculations of thermal whole beam self-focusing, 10:11952 (J;US)
Modulation
Laser-beam cleaning in a plasma compressor, 10:11984 (J;US)
Photoionization
Photoelectron motion in the presence of a probe electromagnetic wave, 10:11794 (J;US)
Pumping
Laser-beam cleaning in a plasma compressor, 10:11984 (J;US)
LASER TARGETS
Compression
Proton spectra diagnostics for shock-compression studies, 10:11956 (J;US)
Shock Waves
Proton spectra diagnostics for shock-compression studies, 10:11956 (J;US)
LASER-PRODUCED PLASMA
Energy Absorption
Two-dimensional Lasnex ray-trace calculations of thermal whole beam self-focusing, 10:11952 (J;US)
Temperature Effects
Two-dimensional Lasnex ray-trace calculations of thermal whole beam self-focusing, 10:11952 (J;US)
LASERS
Light Amplification by Stimulated Emission of Radiation.
See also CHEMICAL LASERS
FREE ELECTRON LASERS
SOLID STATE LASERS
Laser physics and laser techniques. Final technical report 1 February 1982-31 January 1984, 10:11496 (R;US)
Design
Exploding foil technique for achieving a soft x-ray laser, 10:11498 (J;US)
Excitation
Theory of generalized adiabatic following in multilevel systems, 10:11503 (J;NL)
Gain
Demonstration of a soft x-ray amplifier, 10:11499 (J;US)
X Radiation
Demonstration of a soft x-ray amplifier, 10:11499 (J;US)
Exploding foil technique for achieving a soft x-ray laser, 10:11498 (J;US)

LATTICE FIELD THEORY
Phase Transformations
Where is the continuum in lattice quantum chromodynamics?, 10:11858 (J;US)
LATTICES (CRYSTAL)
See CRYSTAL LATTICES
LAWRENCE LIVERMORE LABORATORY
Computer Networks
CLARET user's manual: Mainframe Logs. Revision 1, 10:12017 (R;US)
Personnel
Mortality among the employees of Lawrence Livermore National Laboratory, 10:11714 (RA;US)
Planning
Charting our course, 10:12006 (RA;US)
Research Programs
Energy and Technology Review, 10:12005 (R;US)
LEACHATES
Chemical Composition
Modeling water quality during salty spoil suspension events, 10:10872 (RA;US)
LEAD ALLOYS
Emission Spectra
Effect of the chemical environment on the L and M heavy-ion-induced x-ray satellite emission spectra, 10:11762 (R;US)
Ion Collisions
Effect of the chemical environment on the L and M heavy-ion-induced x-ray satellite emission spectra, 10:11762 (R;US)
X-Ray Spectra
Effect of the chemical environment on the L and M heavy-ion-induced x-ray satellite emission spectra, 10:11762 (R;US)
LEAD COMPOUNDS
See also LEAD OXIDES
Emission Spectra
Effect of the chemical environment on the L and M heavy-ion-induced x-ray satellite emission spectra, 10:11762 (R;US)
Ion Collisions
Effect of the chemical environment on the L and M heavy-ion-induced x-ray satellite emission spectra, 10:11762 (R;US)
X-Ray Spectra
Effect of the chemical environment on the L and M heavy-ion-induced x-ray satellite emission spectra, 10:11762 (R;US)
LEAD OXIDES
Thermodynamic Properties
Coupled diffusion phenomena. Final report, 10:11392 (R;US)
LEAK TESTING
Meetings
CSNI specialist meeting on leak-before-break in nuclear reactor piping: proceedings, 10:11167 (R;US)
LEASING
Environmental Impact Statements
Proposed Gulf of Alaska/Cook Inlet lease sale 88. Final environmental impact statement. Volume 1, 10:10943 (R;US)
Proposed Gulf of Alaska/Cook Inlet lease sale 88. Final environmental impact statement. Volume 2. Appendices, 10:10944 (R;US)
LEPTON-DEUTERON INTERACTIONS
See DEUTERIUM TARGET
LEPTONS
See also MUONS
NEUTRINOS
Pair Production
Recent results from PEP, 10:11821 (R;US)
LEVEL INDICATORS
Performance Testing
Heated thermocouple liquid level system, 10:11122 (R;US)
High temperature, high pressure water level sensor, 10:11090 (R;US)
LIBRARIES
Evaluation
Value of libraries as an intermediary information service. Volume 1, 10:12027 (RA;US)
LIGHT WATER COOLED REACTORS
See WATER COOLED REACTORS
LIGHTING SYSTEMS
Calculation Methods
Fundamental problems with visual performance research described in the CIE 19/2 report, 10:11289 (R;US)
Performance
Fundamental problems with visual performance research described in the CIE 19/2 report, 10:11289 (R;US)
LIMBS
Personnel Dosimetry
Adequacy of current systems for monitoring extremity exposures at nuclear power plants, 10:11905 (R;US)
LINACS
See LINEAR ACCELERATORS
LINEAR ACCELERATORS
See also LAMPF LINAC
MIT BATES LINAC
STANFORD LINEAR COLLIDER
Pulse Generators
Pulsed power for race track induction accelerators, 10:11528 (R;US)
LIQUEFIED NATURAL GAS
Exports
Indonesian oil and gas, 10:11216 (R;US)
LIQUID COLUMN CHROMATOGRAPHY
Gaseous Diffusion
Effect of liquid-phase diffusion resistance on retention time in gas-liquid chromatography, 10:11435 (J;US)
Spectrometers
Micro-column plasma emission liquid chromatograph, 10:11580 (P;US)
LIQUID METAL COOLANT
See LIQUID METALS
LIQUID METALS
Structure Factors
Structure factors for a binary mixture of quantum and classical fermion liquids, 10:11804 (J;US)
LIQUIDS
See also COAL LIQUIDS
LIQUID METALS
Mechanical Properties
Theories of immiscible and structured mixtures, 10:11911 (J;GB)
LITHIUM
Oscillator Strengths
H-Division materials physics quarterly report, April-June 1984, 10:11323 (R;US)
Solvent Extraction
Investigations of ion-size-selective synergism in solvent extraction, 10:11433 (J;US)
LITHIUM ALLOYS
Aging
Small-angle x-ray scattering (SAXS) study of coarsening kinetics in an aluminum-lithium alloy, 10:11331 (R;US)
LITHIUM OXIDES
Microstructure
Microstructural examination of fast-neutron irradiated Li_2O, 10:11390 (R;US)
Scanning Electron Microscopy
Microstructural examination of fast-neutron irradiated Li_2O, 10:11390 (R;US)
LIVER CELLS
Sensitivity
Cell specific activation of benzo[a]pyrene by fibroblasts and hepatocytes (Rats), 10:11710 (J;US)
LMFBR TYPE REACTORS
See also SNR-1 REACTOR
Cesium
Significance of cesium in LMFBR and LWR safety analysis, 10:11164 (R;DE)
Loss of Flow
Two-dimensional modeling of sodium boiling in a simulated LMFBR loss-of-flow test, 10:11155 (R;US)
Reactor Accidents
Use of Kalman filter methods in analysis of in-pile LMFBR accident simulations, 10:11113 (J;US)
Reactor Core Disruption
UO_2 aerosol release from pools of sodium, 10:11156 (R;US)
Reactor Safety
Significance of cesium in LMFBR and LWR safety analysis, 10:11164 (R;DE)

Use of Kalman filter methods in analysis of in-pile LMFBR accident simulations, 10:11113 (J;US)

LNG
See LIQUEFIED NATURAL GAS

LNG SPILLS
See GAS SPILLS

LOAD MANAGEMENT
Computer Calculations
Application of MINOS to a thermal ramping problem, 10:11218 (R;US)

LOCA
See LOSS OF COOLANT

LOCAL GROUP
See GALAXIES

LOFT REACTOR
After-Heat
Application of ANSI/ANS-5.1-1979/HEAT5G code to LOFT technical specifications, 10:11132 (R;US)
Fluid Flow
Comparison of mass flow calculations using drag disc/turbine transducer (DTT) data from the Transient Flow Calibration Facility, 10:11146 (R;US)
Information Validation
Automated data qualification, 10:11147 (R;US)
Velocimeters
Development of a cooled coaxial low flow velocimeter, 10:11148 (R;US)

LONG VALLEY
Deformation
Model for deformation in Long Valley, California, 1980-1983, 10:11727 (J;US)

LONGWALL MINING
Computerized Simulation
Longwall coal mining operations computer simulation, 10:10895 (R;AU)
Mathematical Models
Mine roadway stabilisation, 10:10896 (R;AU)
Mine Roadways
Mine roadway stabilisation, 10:10896 (R;AU)
Support Pillars
Mine roadway stabilisation, 10:10896 (R;AU)

LOS ALAMOS MESON PHYSICS FACILITY
See LAMPF LINAC

LOSS OF COOLANT
Computerized Simulation
Potential for interactive/real time nuclear power plant simulation with RELAP5, 10:11144 (R;US)
Fission Product Release
Behavior of Cs, I, and Te in the fission product release program at ORNL, 10:11157 (R;US)
Heat Transfer
Ability of the TRAC-P1A computer program to predict blowdown, refill, and reflood phenomena during Semiscale Mod-1 experiments, 10:11153 (R;US)
Potential for interactive/real time nuclear power plant simulation with RELAP5, 10:11144 (R;US)
Hydraulics
Ability of the TRAC-P1A computer program to predict blowdown, refill, and reflood phenomena during Semiscale Mod-1 experiments, 10:11153 (R;US)
Development of a cooled coaxial low flow velocimeter, 10:11148 (R;US)
Potential for interactive/real time nuclear power plant simulation with RELAP5, 10:11144 (R;US)
Simulation
Assessment of nuclear fuel rod and solid electric heater thermal behavior during the heatup and reflood phases of a large break LOCA, 10:11152 (R;US)
Evaluation of on-line control techniques for heater rods in the Semiscale Mod-3 system, 10:11140 (R;US)
Hydrogen studies during PBF Severe Fuel Damage tests, 10:11145 (R;US)
Review of experiments to evaluate the ability of electrical heater rods to simulate nuclear fuel rod behavior during postulated loss-of-coolant accidents in light water reactors, 10:11142 (R;US)
Thermal Shock
Experimental verification of the behavior of surface flaws in thick-walled steel cylinders during severe thermal shock, 10:11149 (R;US)

LOSS OF FLOW
Simulation
Two-dimensional modeling of sodium boiling in a simulated LMFBR loss-of-flow test, 10:11155 (R;US)

LOSS OF FLUID TEST REACTOR
See LOFT REACTOR

LOUISIANA
Salt Deposits
Gulf Coast Salt Domes geologic Area Characterization Report, North Louisiana Study Area. Volume IV. Technical report (Contains glossary; Vacherie and Rayburns domes), 10:10975 (R;US)
Measured data from the Avery Island Site C heater test, 10:10967 (R;US)

LOW-LEVEL RADIOACTIVE WASTES
Radioactive Waste Disposal
Characterization and assessment for the Weldon Spring Quarry low-level radioactive waste storage site, 10:10969 (R;US)
Radionuclide migration pathways analysis for the Oak Ridge Central Waste Disposal Facility on the West Chestnut Ridge site, 10:11002 (R;US)

LR-0 REACTOR
Fuel Assemblies
LR-0 research reactor experimental fuel production control, 10:11135 (RA;DE;In Russian)

LUNGS
Gamma Spectroscopy
Lund clearance of neutron-activated Mount St. Helens volanic ash in the rat, 10:11688 (J;US)
Injuries
Potentiating effects of oxygen in lungs damaged by methylcyclopentadienyl manganese tricarbonyl, cadmium chloride, oleic acid, and antitumor drugs, 10:11693 (J;US)
Morphological Changes
Pulmonary toxicity of inhaled coal liquid aerosols (boiling range 230-450°C), 10:10933 (J;US)
Pathological Changes
Lung changes in rats inhaling volcanic ash for one year, 10:11712 (J;US)

LUTETIUM ALLOYS
Electric Conductivity
Phase stability and magnetic properties of UAl_2 based pseudobinary spin fluctuation compounds, 10:11341 (R;US)
Magnetic Susceptibility
Phase stability and magnetic properties of UAl_2 based pseudobinary spin fluctuation compounds, 10:11341 (R;US)
Phase Stability
Phase stability and magnetic properties of UAl_2 based pseudobinary spin fluctuation compounds, 10:11341 (R;US)
Specific Heat
Phase stability and magnetic properties of UAl_2 based pseudobinary spin fluctuation compounds, 10:11341 (R;US)

LUTETIUM SILICIDES
Josephson Effect
Josephson effect in $Lu_2Fe_3Si_5$: Evidence against triplet pairing, 10:11420 (J;US)

LWR TYPE REACTORS
See WATER COOLED REACTORS

LYMPHATIC SYSTEM
Biomedical Radiography
Value of lymphography in the diagnosis of urological tumors, 10:11652 (R;DE;In German)

LYMPHOCYTES
Chromosomal Aberrations
No liquid holding recovery for chromosomal aberrations or sister-chromatid exchanges in irradiated G_1 human lymphocytes, 10:11683 (J;NL)
Genetic Radiation Effects
No liquid holding recovery for chromosomal aberrations or sister-chromatid exchanges in irradiated G_1 human lymphocytes, 10:11683 (J;NL)

LYMPHOID CELLS
See LYMPHOCYTES

M

MA 754
See NICKEL BASE ALLOYS
MACERALS
Separation Processes
Separation and fluorescence characterization of coal macerals , 10:10851 (RA;US)
Structural Chemical Analysis
Coal characteristics and their role in hydrogenation, 10:10858 (R;AU)
MAGNESIUM
Oscillator Strengths
H-Division materials physics quarterly report, April-June 1984, 10:11323 (R;US)
MAGNESIUM FLUORIDES
Density
Pre-eutectic densification in MgF_2-CaF_2, 10:11401 (J;IT)
MAGNESIUM OXIDES
See also SPINELS
Electric Conductivity
Behavior of electrical conduction of spinel and other insulating oxides in moderate electric fields at high temperature, 10:11396 (J;US)
Electron Collisions
Excitation of edge modes in the interaction of electron beams with dielectric wedges, 10:11774 (J;US)
MAGNESIUM SILICATES
See also OLIVINE
Catalytic Effects
Characterization of supported metal catalysts by imaging, microdiffraction and microanalysis techniques, 10:11439 (R;US)
MAGNESIUM SULFATES
Thermodynamic Properties
Isopiestic studies of aqueous solutions at elevated temperatures. VII. $MgSO_4$ and $NiSO_4$, 10:11454 (J;GB)
MAGNETIC BREMSSTRAHLUNG
See SYNCHROTRON RADIATION
MAGNETIC FIELDS
Boundary-Value Problems
Spectral properties for the magnetization integral operator, 10:11925 (J;US)
Calculation Methods
New scalar potential formulation of the magnetostatic field problem, 10:11924 (J;US)
MAGNETIC MATERIALS
See also FERROMAGNETIC MATERIALS
Neutron Diffraction
Neutron scattering investigation of magnetic excitations at high energy transfers, 10:11389 (R;US)
MAGNETIC MIRRORS
Including systems with minimum-B configuration.
See also BUMPY TORI
TANDEM MIRRORS
Axial Symmetry
Stability of an elongated axisymmetric mirror with an energetic axis-encircling ion component, 10:11968 (J;AT)
Orbit Stability
Stability of an elongated axisymmetric mirror with an energetic axis-encircling ion component, 10:11968 (J;AT)
MAGNETIC MONOPOLES
Monoponucleosis: the wonderful things that monopoles can do to nuclei if they are there, 10:11832 (R;US)
Detection
Report on Stanford superconductive monopole detectors, 10:11490 (BA;US)
Zero-quantum superconducting magnetic shield, 10:11491 (BA;US)
Group Theory
Three-cocycle in mathematics and physics, 10:12019 (J;US)
SQUID Devices
Report on Stanford superconductive monopole detectors, 10:11490 (BA;US)
MAGNETIC SHIELDING
Design
Zero-quantum superconducting magnetic shield, 10:11491 (BA;US)
MAGNETIC SPECTROMETERS
Testing
Medium energy physics. Technical progress report, 10:11545 (R;US)
MAGNETITE
Muons Plus
Magnetic interactions, bonding, and motion of positive muons in magnetite, 10:11394 (J;US)
MAGNETOPAUSE
Plasma
Further analysis of plasma bursts in high-latitude boundary layer of earth, 10:11748 (R;US)
MAGNETOSHEATH
Electron Density
Magnetospheric ions and electrons in the distant magnetoshearth at ~50 R/sub E/ and ~180 R/sub E/: ISEE-3 observations, 10:11757 (J;US)
Hydromagnetic Waves
Drift mirror mode waves in the distant (X = 200 R/sub e/) magnetosheath, 10:11758 (J;US)
Plasma Focus
Large scale flow in the dayside magnetosheath, 10:11750 (J;US)
Proton Density
Magnetospheric ions and electrons in the distant magnetoshearth at ~50 R/sub E/ and ~180 R/sub E/: ISEE-3 observations, 10:11757 (J;US)
MAGNETOSPHERE
See also MAGNETOTAIL
PLASMA SHEET
Helium Ions
Charge-state composition of 0.4-MeV helium ions in earth's outer radiation belts during quiet times. Technical report, 10:11734 (R;US)
Ring Currents
Region 1 Birkeland currents from a global MHD simulation of the magnetosphere. Memorandum report, October 1984-October 1985, 10:11733 (R;US)
Shock Waves
Some contributions to knowledge of the magnetospheric plasma by ISEE investigators, 10:11749 (R;US)
MAGNETOTAIL
Electron Plasma Waves
Plasma wave spectra near slow mode shocks in the distant magnetotail, 10:11753 (J;US)
Plasma
Plasma entry into the distant tail lobes: ISEE-3, 10:11756 (J;US)
Plasmoids
Detailed examination of a plasmoid in the distant magnetotail with ISEE 3, 10:11752 (J;US)
Proton Temperature
Simultaneous observation of the plasma sheet in the near earth and distant magnetotail: ISEE-1 and ISEE-3, 10:11751 (J;US)
Shock Waves
Power dissipation at slow-mode shocks in the distant geomagnetic tail, 10:11755 (J;US)
Slow mode shocks in the earth's magnetotail: ISEE-3, 10:11754 (J;US)
MAIZE
Drying
[Computerized control of grain drying operations]. Final technical report, 10:11669 (R;US)
MALIGNANCIES
See NEOPLASMS

MAMMARY GLANDS
Biological Radiation Effects
Survival of mammary epithelial cells from virgin female BALB/c mice following in vivo gamma irradiation, 10:11680 (J;US)
Biomedical Radiography
Ultrasonic mammography. Value and meaning of the method in comparison to X-ray mammography, thermography, and fine needle biopsy, 10:11655 (R;DE;In German)
Biopsy
Ultrasonic mammography. Value and meaning of the method in comparison to X-ray mammography, thermography, and fine needle biopsy, 10:11655 (R;DE;In German)
Thermography
Ultrasonic mammography. Value and meaning of the method in comparison to X-ray mammography, thermography, and fine needle biopsy, 10:11655 (R;DE;In German)
Ultrasonography
Ultrasonic mammography. Value and meaning of the method in comparison to X-ray mammography, thermography, and fine needle biopsy, 10:11655 (R;DE;In German)
MAN
All of mankind, of any age or of either sex.
Environmental Exposure Pathway
Radionuclide migration pathways analysis for the Oak Ridge Central Waste Disposal Facility on the West Chestnut Ridge site, 10:11002 (R;US)
MANGANESE
Biological Availability
Metal regulation and toxicity in aquatic organisms, 10:11703 (BA;US)
Metabolism
Metal regulation and toxicity in aquatic organisms, 10:11703 (BA;US)
Toxicity
Metal regulation and toxicity in aquatic organisms, 10:11703 (BA;US)
MANGANESE ALLOYS
Neutron Diffraction
Paramagnetic scattering from a cubic ferromagnet Pd_2MnSn, 10:11354 (J;US)
MANGANESE COMPOUNDS
Biological Effects
Potentiating effects of oxygen in lungs damaged by methylcyclopentadienyl manganese tricarbonyl, cadmium chloride, oleic acid, and antitumor drugs, 10:11693 (J;US)
MANNOMUSTINE
See ALKYLATING AGENTS
MANUFACTURING FACILITIES
See INDUSTRIAL PLANTS
MANURES
Anaerobic Digestion
Bio-conversion of broiler house litter. Final report, 10:11016 (R;US)
MARINE ECOSYSTEMS
See AQUATIC ECOSYSTEMS
MARKET
Computerized Simulation
Critical points in the coal fuel cycle: continued modeling analysis (CTL version of CSTM), 10:10931 (RA;US)
MARKET SHARES
See MARKET
MASS SPECTROMETERS
Ion Sources
Thermal ion source for quadrupole mass spectrometers, 10:11579 (J;NL)
MASS TRANSIT SYSTEMS
Fuel Supplies
Effects of oil deregulation on public transportation. Final report, 10:11213 (R;US)
MASSACHUSETTS INSTITUTE OF TECHNOLOGY ALC
See ALCATOR DEVICE
MASURIUM
See TECHNETIUM
MATERIALS
See also COMPOSITE MATERIALS
DIELECTRIC MATERIALS
GRANULAR MATERIALS
HAZARDOUS MATERIALS
LASER MATERIALS
MAGNETIC MATERIALS
MATRIX MATERIALS
POROUS MATERIALS
REACTOR MATERIALS
SEMICONDUCTOR MATERIALS
THERMONUCLEAR REACTOR MATERIALS
TISSUE-EQUIVALENT MATERIALS
TOXIC MATERIALS
Research Programs
Materials Sciences Division long range plan, 10:11322 (R;US)
Wave Propagation
Electromagnetic inverse problem for dispersive media, 10:11861 (J;US)
MATERIALS (COMPOSITE)
See COMPOSITE MATERIALS
MATERIALS (DIELECTRIC)
See DIELECTRIC MATERIALS
MATERIALS (FERROMAGNETIC)
See FERROMAGNETIC MATERIALS
MATERIALS (MAGNETIC)
See MAGNETIC MATERIALS
MATERIALS (POROUS)
See POROUS MATERIALS
MATERIALS (SEMICONDUCTOR)
See SEMICONDUCTOR MATERIALS
MATERIALS TESTING
Test Facilities
Technology development facility (TDF), 10:11999 (BA;GB)
MATHEMATICAL MODELS
See also ATOMIC MODELS
COSMOLOGICAL MODELS
Errors
Parameter constraints in a stream ecosystem model: incorporation of a priori information in Monte Carlo error analysis, 10:11634 (J;NL)
Evaluation
Parameter constraints in a stream ecosystem model: incorporation of a priori information in Monte Carlo error analysis, 10:11634 (J;NL)
Nonlinear Problems
Macro for fitting nonlinear models to Poisson distributed data, 10:11927 (R;US)
MATRICES
See also HERMITIAN MATRIX
Factorization
Existence and Computation of LU-factorization with small pivots, 10:12020 (J;US)
Preconditioning by incomplete block cyclic reduction, 10:12021 (J;US)
MATRIX MATERIALS
Materials Testing
Development of molten carbonate fuel cell power plant technology. Quarterly technical progress report No. 19, April 1-June 30, 1984, 10:11273 (R;US)
MECHANICAL FILTERS
Decommissioning
Decontamination and decommissioning of CPP-603 BIF filter room. Final report, 10:10993 (R;US)
Decontamination
Decontamination and decommissioning of CPP-603 BIF filter room. Final report, 10:10993 (R;US)
MECHANICS
See also QUANTUM MECHANICS
Computer Codes
User's and programmer's guide to the mechanics of Moving Finite Element code, 10:12018 (R;US)
Finite Element Method
User's and programmer's guide to the mechanics of Moving Finite Element code, 10:12018 (R;US)
MEGAKARYOCYTES
See BONE MARROW CELLS
MELANOCYTES
See ANIMAL CELLS

MELANOMAS
Epidemiology
Cutaneous melanoma in two populations occupationally exposed to internal deposition of plutonium, 10:11673 (R;US)
Radioinduction
Cutaneous melanoma in two populations occupationally exposed to internal deposition of plutonium, 10:11673 (R;US)
Risk Assessment
Cancer risk among oil-refinery workers: a review of epidemiologic studies, 10:10939 (J;US)
MELTDOWN
Chemical Reactions
Analysis of ex-vessel debris/water interaction and a potential overpressurization of containment, 10:11139 (R;US)
Interaction of hot solid, core debris with concrete, 10:11171 (R;US)
Heat Transfer
Preliminary observation of large scale UO_2 melt-concrete interactions and sustained steel-concrete interaction with an overlying water pool, 10:11173 (R;US)
Hydraulics
Preliminary observation of large scale UO_2 melt-concrete interactions and sustained steel-concrete interaction with an overlying water pool, 10:11173 (R;US)
Radioactive Aerosols
Aerosol instrumentation for the Marviken aerosol transport tests, 10:11131 (J;GB)
Thermal Stresses
Interaction of hot solid, core debris with concrete, 10:11171 (R;US)
MEMBRANES
Permeability
Americium transfer studies using hollow fiber/extractant membranes, 10:10986 (R;US)
MEMORY DEVICES
Optical Systems
Role of optical disk at computing centers, 10:12008 (R;US)
MERCURY
Photoionization
Photoionization study of HgAr, 10:11770 (J;US)
MESON-DEUTERON INTERACTIONS
See DEUTERIUM TARGET
METABOLISM
Tracer Techniques
Damage of the hepatic mixed functional oxygenase system by CCl_4. Significance of incorporation of C-14-Cl_4 metabolites in vivo, 10:11647 (R;DE)
METAGALAXY
See UNIVERSE
METAL INDUSTRY
Casting
[Continuous casting process-prototype]. Final report, 10:11308 (R;US)
Fuel Cells
Potential fuel cell application in the metallurgical industries, 10:11250 (RA;US)
METALLURGY
Use of a more specific term is recommended; see also EXTRACTIVE METALLURGY or FABRICATION.
Ion Implantation
Ion implantation metallurgy, 10:11364 (J;US)
METALS
See also ACTINIDES
ALUMINIUM
ANTIMONY
CADMIUM
GERMANIUM
LIQUID METALS
MERCURY
RARE EARTHS
TRANSITION ELEMENTS
ZINC
Ion Implantation
Tailored surface modification by ion implantation and laser treatment, 10:11362 (J;US)
Muon Probes
Muon spin relaxation, 10:11573 (J;US)
Surface Treatments
Tailored surface modification by ion implantation and laser treatment, 10:11362 (J;US)
METHANATION
Catalysts
Characterization of supported metal catalysts by imaging, microdiffraction and microanalysis techniques, 10:11439 (R;US)
METHANE
Biosynthesis
Bio-conversion of broiler house litter. Final report, 10:11016 (R;US)
Crab waste methane digester. Final report, 10:11014 (R;US)
Methane and fertilizer production from seaweed biomass. Final report, 10:11017 (R;US)
Environmental Transport
Long-range atmospheric tracer field test, 10:11604 (J;GB)
Viscosity
Viscosity of carbon-monoxide mixtures with four gases in the temperature range 25-200°C: supplement, 10:11465 (J;DE)
METHANOGENIC BACTERIA
See also CLOSTRIDIUM ACETOBUTYLICUM
Classification
Antigenic fingerprinting of methanogenic bacteria with polyclonal antibody probes, 10:11662 (J;DE)
Immunology
Methane producing bacteria: immunological characterization. Final Report, 1 April 1981-31 March 1984, 10:11661 (R;US)
METHANOL FUELS
Pure methanol, methanol-water mixtures, or methanol with additives; for methanol-gasoline mixtures, use GASOHOL.
Combustion
Engine wear with methanol fuel in a nitrogen-free environment. Interim report May-December 1983, 10:11320 (R;US)
Combustion Properties
Utilization research, Volume III. Monthly progress report for November 1984, 10:11321 (R;US)
METHYL METHANESULFONATE
Biological Effects
Inducible reactivation of bacteriophage T7 damaged by methyl methanesulfonate or UV light, 10:11689 (J;US)
METHYL RADICALS
Chemical Reaction Kinetics
Reactions of methyl and ethyl radicals with uranium hexafluoride, 10:11470 (J;US)
METHYLAMINE
Biological Effects
Ammonia regulation of intermediary metabolism in photosynthesizing and respiring Chlorella pyrenoidosa: comparative effects of methylamine, 10:11695 (J;JP)
METHYLBENZENE
See TOLUENE
METHYL-FUEL
See ALCOHOLS
MICE
Lethal Radiation Dose
Relative biological effectiveness measurements using murine lethality and survival of intestinal and hematopoietic stem cells after Fermilab neutrons compared to JANUS reactor neutrons and ^{60}Co gamma rays, 10:11681 (J;US)
MICELLAR-POLYMER FLOODING
See MICROEMULSION FLOODING
MICROBIAL ENHANCED OIL RECOVERY
See MICROBIAL EOR
MICROBIAL EOR
Bench-Scale Experiments
Contracts for field projects and supporting research on enhanced oil recovery. Progress Review No. 39, quarter ending June 30, 1984, 10:10935 (R;US)
MICROBIAL FLORA
See MICROORGANISMS
MICROEMULSION FLOODING
Bench-Scale Experiments
Contracts for field projects and supporting research on enhanced oil recovery. Progress Review No. 39, quarter ending June 30, 1984, 10:10935 (R;US)

Field Tests
Contracts for field projects and supporting research on enhanced oil recovery. Progress Review No. 39, quarter ending June 30, 1984, 10:10935 (R;US)

MICROFLORA
See MICROORGANISMS

MICROORGANISMS
Photosensitivity
Mechanisms of photosensititization by furocoumarins, 10:11686 (R;US)

MICROWAVE AMPLIFIERS
Performance
60 GHz, 200 kW CW gyrotron with high output mode purity, 10:11973 (R;US)

MILITARY EQUIPMENT
Acid Electrolyte Fuel Cells
Carbon monoxide tolerant anodes and freeze resistant electrodes, 10:11259 (RA;US)

MILITARY FACILITIES
Photovoltaic Power Supplies
Federal Photovoltaic Utilization Program. Final report, 10:11042 (R;US)

MILLET
Plant Breeding
Development of innovative techniques and principles that may be used as models to improve plant performance. Progress report, 10:11668 (R;US)

MINE ROADWAYS
Stabilization
Mine roadway stabilisation, 10:10896 (R;AU)

MINE-MOUTH GENERATING PLANTS
See COAL MINES
FOSSIL-FUEL POWER PLANTS

MINERALS
See also ZEOLITES
Physical Radiation Effects
Effects of alpha irradiation on barium hollandite and nickel-iron spinel (Barium hollandite ($BaAl_2Ti_6O_{16}$)), 10:11410 (R;US)

MINORITY GROUPS
Energy Consumption
Residential energy consumption characteristics of minority population groups: trends in demand and patterns of use, 10:11219 (R;US)

MIRRORS (MAGNETIC)
See MAGNETIC MIRRORS

MISSISSIPPI
Salt Deposits
Gulf Coast Salt Domes geologic Area Characterization Report, Mississippi Study Area. Volume VII. Appendix (Cypress Creek, Lampton, and Richton domes), 10:10976 (R;US)

MISSOURI
Geology
Characterization and assessment for the Weldon Spring Quarry low-level radioactive waste storage site, 10:10969 (R;US)
Hydrology
Characterization and assessment for the Weldon Spring Quarry low-level radioactive waste storage site, 10:10969 (R;US)
Remedial Action
Characterization and assessment for the Weldon Spring Quarry low-level radioactive waste storage site, 10:10969 (R;US)

MIT BATES LINAC
Bates Electron Linear Accelerator Facility at MIT.
Magnetic Spectrometers
Medium energy physics. Technical progress report, 10:11545 (R;US)
Polarized Beams
Medium energy physics. Technical progress report, 10:11545 (R;US)

MIXED OXIDE FUELS
Uranium dioxide mixed with other oxides.
Fabrication
Fabrication and quality control of mixed oxide LWR fuel with regard to homogeneity of fissile content, 10:11083 (RA;DE)
Quality Control
Fabrication and quality control of mixed oxide LWR fuel with regard to homogeneity of fissile content, 10:11083 (RA;DE)

MIXTURES
See also BINARY MIXTURES
Mechanical Properties
Theories of immiscible and structured mixtures, 10:11911 (J;GB)

MMS
See METHYL METHANESULFONATE

MOBILE HOMES
Thermal Insulation
Comparison of manufactured-housing thermal characteristics, 10:11294 (R;US)

MOBILITY
Not for material movement; see also TRANSPORT.
Control
Mobility control for CO_2 injection (support for field project). Fourteenth quarterly report including project status report, August 17-November 17, 1984, 10:10937 (R;US)

MODELS (ATOMIC)
See ATOMIC MODELS

MODELS (BIOLOGICAL)
See BIOLOGICAL MODELS

MODELS (COSMOLOGICAL)
See COSMOLOGICAL MODELS

MODELS (MATHEMATICAL)
See MATHEMATICAL MODELS

MODES (OSCILLATION)
See OSCILLATION MODES

MOLECULAR ORBITAL MODEL
See ATOMIC MODELS
MOLECULES

MOLECULAR SIEVES
Mathematical Models
Scaling theory of desorption from molecular-sieve materials, 10:11919 (J;US)
Porosity
Scaling theory of desorption from molecular-sieve materials, 10:11919 (J;US)

MOLECULES
See also POLYATOMIC MOLECULES
Coupling
Photoelectron motion in the presence of a probe electromagnetic wave, 10:11794 (J;US)
Electronic Structure
Ab initio effective core potentials for molecular calculations. Potentials for K to Au including the outermost core orbitals, 10:11780 (J;US)
Inelastic Scattering
Wave packet approach to inelastic scattering from large targets, 10:11777 (J;US)
Photoionization
Photoelectron motion in the presence of a probe electromagnetic wave, 10:11794 (J;US)

MOLLUSCS
Ecology
Gastropod shells: a dynamic resource that helps shape benthic community structure (Calliactis tricolor; Pagurus pollicaris; Calappa flammea; Octopus joubini; Panulirus argus), 10:11630 (J;NL)

MOLTEN CARBONATE FUEL CELLS
Prior to June 1980 this information was indexed with the descriptors HIGH-TEMPERATURE FUEL CELLS + MOLTEN SALTS + CARBONATES.
Anodes
Development of molten carbonate fuel cell power plant technology. Quarterly technical progress report No. 19, April 1-June 30, 1984, 10:11273 (R;US)
Molten carbonate fuel cell component development, 10:11238 (RA;US)
Battery Separators
Molten carbonate fuel cell component development, 10:11238 (RA;US)
Cathodes
Development of molten carbonate fuel cell power plant technology. Quarterly technical progress report No. 19, April 1-June 30, 1984, 10:11273 (R;US)

Molten carbonate fuel cell cathode materials study, 10:11278 (J;US)
Stable materials for molten carbonate fuel cell cathodes, 10:11237 (RA;US)
Design
Component development for direct fuel cell, 10:11235 (RA;US)
Economics
Techno-economic evaluation of a direct fuel cell system, 10:11234 (RA;US)
Electrocatalysts
Status of molten carbonate fuel cell development at United Technologies Corporation, 10:11236 (RA;US)
Electrodes
Molten carbonate fuel cell performance model update. Quarterly report, April-June 1984. Draft, 10:11276 (R;US)
Leaks
Status of molten carbonate fuel cell development at United Technologies Corporation, 10:11236 (RA;US)
Matrix Materials
Development of molten carbonate fuel cell power plant technology. Quarterly technical progress report No. 19, April 1-June 30, 1984, 10:11273 (R;US)
Molten carbonate fuel cell component development, 10:11238 (RA;US)
Performance
Molten carbonate fuel cell performance model update. Quarterly report, April-June 1984. Draft, 10:11276 (R;US)
Performance Testing
Development of molten carbonate fuel cell power plant technology. Quarterly technical progress report No. 19, April 1-June 30, 1984, 10:11273 (R;US)
Reformer Processes
Component development for direct fuel cell, 10:11235 (RA;US)
Research Programs
Molten carbonate fuel cells: development status, 10:11229 (RA;US)
Status of Japanese molten carbonate fuel cell program, 10:11269 (RA;US)
Test Facilities
Status of Japanese molten carbonate fuel cell program, 10:11269 (RA;US)

MOLTEN SALT COOLANTS
See MOLTEN SALTS

MOLTEN SALTS
Tritium Recovery
Tritium permeation and recovery for the helium-cooled molten salt fusion breeder, 10:11983 (R;US)

MOLYBDATES
Specific compounds should be indexed by coordination of a descriptor of the form (CATION) COMPOUNDS and the above anion descriptor.
Catalytic Effects
Simple molybdate selective oxidation catalysts containing excess MoO_3 for C_4 hydrocarbon oxidation to maleic anhydride, 10:11462 (R;US)

MOLYBDENUM
Catalytic Effects
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 1, October-December 1983, 10:11458 (R;US)
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 4, July-September 1984, 10:11459 (R;US)
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 3, April-June 1984, 10:11460 (R;US)
Ion Collisions
Ultrahigh-resolution studies of heavy-ion-induced x-ray satellite emission, 10:11763 (R;US)
Phonons
Vibrational frequencies and structural properties of transition metals via total-energy calculations, 10:11339 (R;US)
Sorptive Properties
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 3, April-June 1984, 10:11460 (R;US)

MOLYBDENUM 92 REACTIONS
Deep Inelastic Heavy Ion Reactions
Reaction mechanisms in the collision of ^{92}Mo on ^{92}Mo at an incident energy of 14.7 MeV/Nucleon, 10:11876 (R;DE;In German)
Inclusive Interactions
Reaction mechanisms in the collision of ^{92}Mo on ^{92}Mo at an incident energy of 14.7 MeV/Nucleon, 10:11876 (R;DE;In German)

MOLYBDENUM 92 TARGET
Molybdenum 92 Reactions
Reaction mechanisms in the collision of ^{92}Mo on ^{92}Mo at an incident energy of 14.7 MeV/Nucleon, 10:11876 (R;DE;In German)

MOLYBDENUM ALLOYS
See also INCONEL 625
STAINLESS STEEL-316
Oxidation
Isotope studies of Fe-18Cr-3Mo (100) oxidation using Raman spectroscopy, 10:11351 (R;US)

MOLYBDENUM COMPLEXES
Chemical Reactions
Synthesis and characterization of tetranuclear molybdenum iodide clusters, 10:11444 (R;US)
Structural Chemical Analysis
Synthesis and characterization of tetranuclear molybdenum iodide clusters, 10:11444 (R;US)
Synthesis
Synthesis and characterization of tetranuclear molybdenum iodide clusters, 10:11444 (R;US)

MONGRELS
See DOGS

MONOPOLES
See also MAGNETIC MONOPOLES
Field Equations
Bound and radiation fields of a pointlike SO(3) monopole, 10:11859 (J;US)

MOROCCO
Industrial Plants
Industrial energy conservation in Morocco and Senegal, 10:11305 (RA;US)

MULTI-CHANNEL ANALYZERS
Design
Multichannel random pulse counter, 10:11578 (J;GB)

MULTICHARGED IONS
Ions with charge 3 and above. Coordinate the above descriptor with a descriptor for the specific ion.
Photoionization
Synchrotron radiation production and trapping of highly charged ions, 10:11538 (R;US)
Trapping
Synchrotron radiation production and trapping of highly charged ions, 10:11538 (R;US)

MULTIWIRE DRIFT CHAMBERS
See DRIFT CHAMBERS

MULTIWIRE PROPORTIONAL CHAMBERS
See also DRIFT CHAMBERS
Performance
Particle detector performance in a Fermilab experiment (E-615 detector), 10:11548 (R;US)

MUNICIPAL WASTES
Waste Disposal
Mobility of toxic compounds from hazardous wastes. Report for January 1982-December 1983, 10:11190 (R;US)
Waste Processing
Effectiveness of regional committees in implementing regional resource recovery programs, 10:11314 (R;US)

MUON PAIRS
Pair Production
Particle detector performance in a Fermilab experiment (E-615 detector), 10:11548 (R;US)

MUON PROBES
Uses
Muon spin relaxation, 10:11573 (J;US)

MUONS
Magnetic Moments
Second-order corrections to the muon anomalous magnetic moment in alternative electroweak models, 10:11847 (J;US)
MUSEUMS
See EDUCATIONAL FACILITIES
MWPC
See MULTIWIRE PROPORTIONAL CHAMBERS

N

NAL SYNCHROTRON
See FERMILAB ACCELERATOR
NAPHTHALENE
Hydrogenation
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 4, July-September 1984, 10:11459 (R;US)
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 3, April-June 1984, 10:11460 (R;US)
NATIONAL ACCELERATOR LABORATORY
See FERMILAB ACCELERATOR
NATIONAL INSTITUTE FOR PETROLEUM AND ENER
See NIPER
NATIONAL REACTOR TESTING STATION
See IDAHO NATIONAL ENGINEERING LABORATORY
NATIONAL REACTOR TESTING STATION BURST FA
See PBF REACTOR
NATIONAL SYNCHROTRON LIGHT SOURCE
See NSLS
NATURAL CIRCULATION
See NATURAL CONVECTION
NATURAL CONVECTION
Mathematical Models
Investigation of a natural convection in a small slot using a finite difference method, 10:11509 (R;DE;In German)
Numerical Solution
Numerical solution of natural convection in eccentric annuli, 10:11511 (J;US)
Windows
Investigation of a natural convection in a small slot using a finite difference method, 10:11509 (R;DE;In German)
NATURAL GAS
See also LIQUEFIED NATURAL GAS
Data Compilation
Natural Gas Monthly, October 1984, 10:10947 (R;US)
Fuel Consumption
Natural Gas Monthly, October 1984, 10:10947 (R;US)
Market
Increasing competition in the natural gas market, 10:10948 (R;US)
Prices
Indonesian oil and gas, 10:11216 (R;US)
Natural Gas Monthly, October 1984, 10:10947 (R;US)
Production
Indonesian oil and gas, 10:11216 (R;US)
Reserves
Indonesian oil and gas, 10:11216 (R;US)
Spot Market
Spot and futures markets for natural gas, 10:10946 (R;US)
Transport
Disaggregating regional energy supply/demand and flow data to 173 BEAs in support of the national energy transportation study. Final report (In USA by pipeline, rail, truck and barge; potential bottlenecks between 1955 to 1995), 10:11210 (R;US)
Rate-of-return regulation and efficiency: the economics of the natural gas pipeline and distribution industry, 10:10953 (R;US)
NATURAL GAS DEPOSITS
Leasing
Proposed Gulf of Alaska/Cook Inlet lease sale 88. Final environmental impact statement. Volume 1, 10:10943 (R;US)
Proposed Gulf of Alaska/Cook Inlet lease sale 88. Final environmental impact statement. Volume 2. Appendices, 10:10944 (R;US)
Offshore Drilling
Draft environmental impact statement: proposed oil and gas lease sales 94, 98, and 102 (Gulf of Mexico region), 10:11639 (R;US)
Resource Potential
Unconventional natural gas, 10:10949 (R;US)
NATURAL GAS DISTRIBUTION SYSTEMS
Constraints
Disaggregating regional energy supply/demand and flow data to 173 BEAs in support of the national energy transportation study. Final report (In USA by pipeline, rail, truck and barge; potential bottlenecks between 1955 to 1995), 10:11210 (R;US)
Efficiency
Rate-of-return regulation and efficiency: the economics of the natural gas pipeline and distribution industry, 10:10953 (R;US)
NATURAL GAS GATHERING SYSTEMS
See NATURAL GAS DISTRIBUTION SYSTEMS
NATURAL GAS POLICY ACT
Increasing competition in the natural gas market, 10:10948 (R;US)
NATURAL GAS WELLS
Explosive Fracturing
Devonian production needs stimulation, 10:10952 (J;ZZ)
Well Stimulation
95 stimulations in 63 wells, 10:10951 (J;ZZ)
NATURAL LIGHTING
See DAYLIGHTING
NATURE RESERVES
Management
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 13, Appendix M: Oak Ridge National Environmental Research Park, 10:11203 (R;US)
NAVAL OIL SHALE RESERVES
Baseline Ecology
Naval Oil Shale Reserves 1 and 3. Five years of progress on the Oil Shale Predevelopment Program: summary, 10:10954 (R;US)
Resource Development
Naval Oil Shale Reserves 1 and 3. Five years of progress on the Oil Shale Predevelopment Program: summary, 10:10954 (R;US)
Resource Potential
Naval Oil Shale Reserves 1 and 3. Five years of progress on the Oil Shale Predevelopment Program: summary, 10:10954 (R;US)
NEODYMIUM COMPOUNDS
See also NEODYMIUM OXIDES
Physical Radiation Effects
Self-radiation damage in actinide host phases of nuclear waste forms ($Ca_2Nd_8(SiO_4)_6O_2$; $Gd_2Ti_2O_7$; $CaZrTi_2O_7$), 10:10981 (R;US)
NEODYMIUM LASERS
Emission Spectra
Research and development of laser glasses in China, 10:11501 (J;CN;CH)
NEODYMIUM OXIDES
Atmospheric Chemistry
Application of quantum chemistry of atmospheric chemistry. Annual report, 1 October 1983-30 September 1984, 10:11438 (R;US)
NEON
Atom-Atom Collisions
Laser induced fluorescence study of Xe($5p^56p$, $5p^56p'$, $5p^57p$, and $5p^56d$) states in Ne and Ar: Radiative lifetimes and collisional deactivation rate constants, 10:11792 (J;US)
Energy Transfer
Energy transfer studies between Ne and H_2O, 10:11801 (J;NL)
Excitation
Energy transfer studies between Ne and H_2O, 10:11801 (J;NL)

NEOPLASMS
See also MELANOMAS
Risk Assessment
Cancer risk among oil-refinery workers: a review of epidemiologic studies, 10:10939 (J;US)
NEPTUNIUM
Adsorption
Progress in evaluation of radionuclide geochemical information developed by DOE high-level nuclear waste repository site projects. Report for January-March 1984, 10:11001 (R;US)
Electrodeposition
Electrodeposition of Neptunium(V) films on noble metal electrodes, 10:11474 (J;DE)
Solubility
Progress in evaluation of radionuclide geochemical information developed by DOE high-level nuclear waste repository site projects. Report for January-March 1984, 10:11001 (R;US)
Structural Chemical Analysis
Electrodeposition of Neptunium(V) films on noble metal electrodes, 10:11474 (J;DE)
NEPTUNIUM 237
Sorption
Influence of basalt/groundwater interactions on radionuclide migration, 10:10998 (R;US)
NETWORKS (COMPUTER)
See COMPUTER NETWORKS
NEUTRAL ATOM BEAM INJECTION
Data Acquisition Systems
Computer control and data acquisition for neutral beam injectors, 10:11996 (BA;GB)
Impurities
Laser-induced fluorescence of metal-atom impurities in a neutral beam, 10:11935 (R;US)
On-Line Control Systems
Computer control and data acquisition for neutral beam injectors, 10:11996 (BA;GB)
NEUTRAL BEAM SOURCES
Beam Dumps
Diagnostics for the NBETF actively cooled beamdump, 10:11977 (R;US)
NEUTRINO OSCILLATION
Gauge theories, massive neutrinos, and proton decay, 10:11812 (B;US)
NEUTRINO-PROTON INTERACTIONS
Elastic Scattering
Preliminary results on neutrino proton elastic scattering, 10:11819 (R;US)
NEUTRINOS
See also SOLAR NEUTRINOS
Mass
Gauge theories, massive neutrinos, and proton decay, 10:11812 (B;US)
NEUTRON ACTIVATION ANALYSIS
See NEUTRON REACTIONS
NEUTRON CAPTURE
See NEUTRON REACTIONS
NEUTRON DOSIMETRY
Digital Systems
Studies of a digital approach to neutron dosimetry and microdosimetry, 10:11903 (R;US)
NEUTRON MATTER
See NUCLEAR MATTER
NEUTRON REACTIONS
Capture
Resonance neutron capture by $^{39,41}K$, 10:11872 (J;US)
Charge-Exchange Reactions
Nuclear reaction n + ^{3}He -> ^{1}H + ^{3}H as proximity reaction, 10:11869 (R;DE;In German)
Cross Sections
Simultaneous evaluation of interrelated cross sections by generalized least-squares and related data file requirements, 10:11862 (R;US)
Thermal Fission
Least squares fit of thermal data for fissile nuclei, 10:11881 (R;US)
NEUTRON SPECTROMETERS
Efficiency
Proposed 14-MeV neutron spectrometer system for jet, 10:11947 (R;SE)
Resolution
Proposed 14-MeV neutron spectrometer system for jet, 10:11947 (R;SE)
NEUTRON TRANSPORT
Computer Calculations
Monte Carlo calculation of energy deposition and ionization yield for high energy protons, 10:11901 (R;US)
Recoils
Monte Carlo calculation of energy deposition and ionization yield for high energy protons, 10:11901 (R;US)
NEUTRONS
See also FAST NEUTRONS
Neutrons and charged particles in radiotherapy. Oncology overview, 10:11659 (R;US)
NEVADA TEST SITE
Geologic Structures
Geologic structure mapping database Spent Fuel Test - Climax, Nevada Test Site, 10:10992 (R;US)
NEW SOUTH WALES
Coal Mining
Planning framework for the accommodation for coal development by Wollongong City, 10:10932 (R;AU)
NICKEL
Catalytic Effects
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 1, October-December 1983, 10:11458 (R;US)
Characterization of supported metal catalysts by imaging, microdiffraction and microanalysis techniques, 10:11439 (R;US)
Diffusion
Reaction of amorphous NiNb films with crystalline metal overlayers, 10:11350 (R;US)
Ductility
Mechanical properties of electrodeposited nickel and copper, 10:11348 (R;US)
Electrodeposition
Mechanical properties of electrodeposited nickel and copper, 10:11348 (R;US)
Use of electrodeposition to provide coatings for solid state bonding, 10:11384 (J;US)
Electron Collisions
Interaction of low energy electrons with surface lattice vibrations. Final report, 10:11764 (R;US)
Embrittlement
Chemical state investigation of grain boundary segregated sulfur in polycrytstalline nickel, 10:11380 (J;US)
Impurities
Tracer diffusion of Ge in Ni single crystals, 10:11382 (J;GB)
Intergranular Corrosion
Role of segregated P and S in intergranular stress corrosion cracking of nickel, 10:11346 (R;US)
Lattice Vibrations
Interaction of low energy electrons with surface lattice vibrations. Final report, 10:11764 (R;US)
Solvent Extraction
Kinetics and mechanism of the interfacial mass transfer of Zn^{2+}, Co^{2+} and Ni^{2+} in the system: bis(2-ethylhexyl)phosphoric acid, n-dodecane - KNO_3, water, 10:11434 (J;US)
Sorptive Properties
Electron energy loss spectroscopy of H_2S adsorbed on Ni(100), 10:11451 (J;US)
Stress Corrosion
Role of segregated P and S in intergranular stress corrosion cracking of nickel, 10:11346 (R;US)
Tensile Properties
Mechanical properties of electrodeposited nickel and copper, 10:11348 (R;US)
Thickness
Mechanical properties of electrodeposited nickel and copper, 10:11348 (R;US)

Vacancies
Tracer diffusion of Ge in Ni single crystals, 10:11382 (J;GB)
Wettability
Wetting of nickel by silver, 10:11381 (J;GB)
NICKEL 60 TARGET
Oxygen 16 Reactions
Precompound limits of linear momentum transfer in heavy ion reactions, 10:11874 (J;US)
NICKEL ALLOYS
See also CHROMIUM-NICKEL STEELS
NICKEL BASE ALLOYS
Annealing
Reaction of amorphous NiNb films with crystalline metal overlayers, 10:11350 (R;US)
Crystallization
Reaction of amorphous NiNb films with crystalline metal overlayers, 10:11350 (R;US)
Ductility
Ductile ordered intermetallic alloys, 10:11363 (J;US)
Electrodeposition
Use of electrodeposition to provide coatings for solid state bonding, 10:11384 (J;US)
Fabrication
Ductile ordered intermetallic alloys, 10:11363 (J;US)
Magnetic Properties
Magnetic studies of $Ni_3Al(Fe)$ compounds, 10:11330 (R;US)
Permeability
Reaction of amorphous NiNb films with crystalline metal overlayers, 10:11350 (R;US)
Stability
Reaction of amorphous NiNb films with crystalline metal overlayers, 10:11350 (R;US)
Thermal Diffusion
Analysis of concentration profiles for fluxes, diffusion depths, and zero-flux planes in multicomponent diffusion, 10:11368 (J;US)
NICKEL BASE ALLOYS
See also HASTELLOY N
Brittle-Ductile Transitions
Flow localization accompanying the intergranular fracture of Ni_3Al, 10:11369 (J;US)
Fracture Properties
Flow localization accompanying the intergranular fracture of Ni_3Al, 10:11369 (J;US)
Phase Studies
Investigation of the isothermal precipitation behaviour of nickel-base alloys using electrochemical phase extraction, 10:11340 (R;DE;In German)
Plasticity
Flow localization accompanying the intergranular fracture of Ni_3Al, 10:11369 (J;US)
Precipitation
Investigation of the isothermal precipitation behaviour of nickel-base alloys using electrochemical phase extraction, 10:11340 (R;DE;In German)
NICKEL COMPOUNDS
See also NICKEL SULFATES
Catalytic Effects
Simple molybdate selective oxidation catalysts containing excess MoO_3 for C_4 hydrocarbon oxidation to maleic anhydride, 10:11462 (R;US)
NICKEL SULFATES
Thermodynamic Properties
Isopiestic studies of aqueous solutions at elevated temperatures. VII. $MgSO_4$ and $NiSO_4$, 10:11454 (J;GB)
NIOBIUM
Diffusion
Reaction of amorphous NiNb films with crystalline metal overlayers, 10:11350 (R;US)
Electronic Structure
Nuclear-magnetic-resonance study of electronic structure in the copper-niobium superlattice, 10:11356 (J;US)
Josephson Effect
Josephson effect in $Lu_2Fe_3Si_5$: Evidence against triplet pairing, 10:11420 (J;US)
Nuclear Magnetic Resonance
Nuclear-magnetic-resonance study of electronic structure in the copper-niobium superlattice, 10:11356 (J;US)
Phonons
Vibrational frequencies and structural properties of transition metals via total-energy calculations, 10:11339 (R;US)
Sorptive Properties
Hydrogen chemisorption on transition metal clusters, 10:11449 (J;US)
NIOBIUM ALLOYS
See also INCONEL 600
INCONEL 625
Annealing
Reaction of amorphous NiNb films with crystalline metal overlayers, 10:11350 (R;US)
Crystallization
Reaction of amorphous NiNb films with crystalline metal overlayers, 10:11350 (R;US)
Diffusion Coatings
Production and testing of an s-band resonator with a Nb_3Sn surface, 10:11555 (R;DE;In German)
Emission Spectra
Effect of the chemical environment on the L and M heavy-ion-induced x-ray satellite emission spectra, 10:11762 (R;US)
Ion Collisions
Effect of the chemical environment on the L and M heavy-ion-induced x-ray satellite emission spectra, 10:11762 (R;US)
Permeability
Reaction of amorphous NiNb films with crystalline metal overlayers, 10:11350 (R;US)
Stability
Reaction of amorphous NiNb films with crystalline metal overlayers, 10:11350 (R;US)
X-Ray Spectra
Effect of the chemical environment on the L and M heavy-ion-induced x-ray satellite emission spectra, 10:11762 (R;US)
NIOBIUM COMPOUNDS
Emission Spectra
Effect of the chemical environment on the L and M heavy-ion-induced x-ray satellite emission spectra, 10:11762 (R;US)
Ion Collisions
Effect of the chemical environment on the L and M heavy-ion-induced x-ray satellite emission spectra, 10:11762 (R;US)
X-Ray Spectra
Effect of the chemical environment on the L and M heavy-ion-induced x-ray satellite emission spectra, 10:11762 (R;US)
NIPER
Research Programs
Energy production research, Volume I. Monthly progress report for November 1984, 10:10938 (R;US)
Utilization research, Volume III. Monthly progress report for November 1984, 10:11321 (R;US)
NITRIC OXIDE
NO.
Auger Effect
Nitrogen K-shell photoemission and Auger emission from N_2 and NO, 10:11789 (J;US)
Chemisorption
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 4, July-September 1984, 10:11459 (R;US)
Concentration Ratio
Stratospheric NO and NO2 profiles at sunset from analysis of high-resolution balloon-borne infrared solar absorption spectra obtained at 33 deg N and calculations with a time-dependent photochemical model, 10:11589 (R;US)
Desorption
NO thermally desorbed from a saturation coverage on Pt(111): Internal state distributions, 10:11445 (J;US)
Photoelectron Spectroscopy
Nitrogen K-shell photoemission and Auger emission from N_2 and NO, 10:11789 (J;US)
NITRO COMPOUNDS
Biological Effects
Excision repair of ultraviolet- and chemically-induced damage in the DNA of fibroblasts derived from two closely related species of marine fishes, 10:11701 (J;NL)

NITROGEN
Adducts
Thermal electron attachment to van der Waals molecules containing O_2, 10:11452 (J;US)
Auger Effect
Nitrogen K-shell photoemission and Auger emission from N_2 and NO, 10:11789 (J;US)
Electron-Molecule Collisions
Application of R-matrix theory to resonant reactive electron-molecule scattering: Vibrational excitation and dissociative attachment of N_2 and F_2, 10:11797 (J;US)
Noise in strong laser-atom interactions: Frequency fluctuations and nonexponential correlations, 10:11798 (J;US)
Energy Absorption
Measurement of the radial density distribution of the light emissions near the trajectory of fast ions in nitrogen, 10:11898 (R;DE;In German)
Photoelectron Spectroscopy
Nitrogen K-shell photoemission and Auger emission from N_2 and NO, 10:11789 (J;US)
NITROGEN 14 TARGET
Silicon 28 Reactions
Nuclear physics experiments with the ORNL-HHIRF supersonic gas jet target, 10:11868 (R;US)
NITROGEN DIOXIDE
NO_2.
Concentration Ratio
Stratospheric NO and NO2 profiles at sunset from analysis of high-resolution balloon-borne infrared solar absorption spectra obtained at 33 deg N and calculations with a time-dependent photochemical model, 10:11589 (R;US)
NITROGEN FLUORIDES
Chemical Bonds
Bonding and ionization energies of N—F and P—F compounds, 10:11450 (J;US)
Formation Heat
Bonding and ionization energies of N—F and P—F compounds, 10:11450 (J;US)
Ionization Potential
Bonding and ionization energies of N—F and P—F compounds, 10:11450 (J;US)
NITROGEN NITRIDES
See NITROGEN
NITROGEN OXIDES
See also NITRIC OXIDE
NITROGEN DIOXIDE
Chemical Reaction Yield
Combustion characteristics of synthetic liquid fuels. Quarterly technical progress report,January 1-March 31, 1982, 10:11013 (R;US)
Dissociation
Turbulence and the distortion of reactions. Progress report, September 1, 1983-September 1, 1984, 10:11765 (R;US)
Sorption
[Evaluation of NOXSO combined NO/sub x/ and SO_2 flue gas cleanup]. Monthly progress report, April 1-30, 1983, 10:10865 (R;US)
Evaluation of the NOXSO combined NO/sub x//SO_2 flue gas treatment process: process chemistry, reaction kinetics and sorbent performance. Monthly progress report, March 1, 1983-March 31, 1983, 10:10864 (R;US)
Synthesis
Formation of nitrogen oxides from the combustion of Yallourn brown coal, 10:10927 (R;AU)
NITROSAMINES
Metabolic Activation
Studies on the relationship between dimethylnitrosamine-demethylase activity and dimethylnitrosamine-dependent mutagenesis in Drosophila melanogaster, 10:11711 (J;NL)
Mutagenesis
Studies on the relationship between dimethylnitrosamine-demethylase activity and dimethylnitrosamine-dependent mutagenesis in Drosophila melanogaster, 10:11711 (J;NL)
NITROSO COMPOUNDS
See also NITROSAMINES
NITROSOUREAS
Mutagenesis
Rapid changes in deoxynucleoside triphosphate pools in mammalian cells treated with mutagens, 10:11692 (J;US)
NITROSOUREAS
Biological Effects
Effect of ethyl-, methyl- and hydroxyethyl-nitrosourea on the mouse testis, 10:11705 (J;NL)
Mutagenesis
Analysis of a mouse α-globin gene mutation induced by ethylnitrosourea, 10:11691 (J;US)
Effect of ethyl-, methyl- and hydroxyethyl-nitrosourea on the mouse testis, 10:11705 (J;NL)
NMR
See NUCLEAR MAGNETIC RESONANCE
NONLINEAR OPTICS
Photon-Atom Collisions
Noise in strong laser-atom interactions. Phase telegraph noise, 10:11795 (J;US)
NONRADIOACTIVE WASTES
See SOLID WASTES
WASTES
NORADRENALINE
Metabolism
Response of the adrenergic system in the cadmium-induced hypertensive rat, 10:11707 (J;US)
NOREPINEPHRINE
See NORADRENALINE
NOS. 4, 5, AND 6 FUEL OILS
See RESIDUAL FUELS
NOS. 5 AND 6 BURNER OILS
See RESIDUAL FUELS
NOXSO PROCESS
Chemical Reaction Kinetics
Evaluation of the NOXSO combined NO/sub x//SO_2 flue gas treatment process: process chemistry, reaction kinetics and sorbent performance. Monthly progress report, March 1, 1983-March 31, 1983, 10:10864 (R;US)
Chemistry
[Evaluation of NOXSO combined NO/sub x/ and SO_2 flue gas cleanup]. Monthly progress report, April 1-30, 1983, 10:10865 (R;US)
Economic Analysis
[Evaluation of NOXSO combined NO/sub x//SO/sub x/ flue gas cleanup]. Monthly progress report, June 1-June 30, 1983, 10:10866 (R;US)
[Evaluation of NOXSO combined NO/sub x/ and SO_2 flue gas cleanup]. Monthly progress report, April 1-30, 1983, 10:10865 (R;US)
Evaluation
[Evaluation of NOXSO combined NO/sub x//SO/sub x/ flue gas cleanup]. Monthly progress report, June 1-June 30, 1983, 10:10866 (R;US)
Research Programs
[Evaluation of NOXSO combined NO/sub x/ and SO_2 flue gas cleanup]. Monthly progress report, April 1-30, 1983, 10:10865 (R;US)
Evaluation of the NOXSO combined NO/sub x//SO_2 flue gas treatment process: process chemistry, reaction kinetics and sorbent performance. Monthly progress report, March 1, 1983-March 31, 1983, 10:10864 (R;US)
NRTS
See IDAHO NATIONAL ENGINEERING LABORATORY
NSLS
Multicharged Ions
Synchrotron radiation production and trapping of highly charged ions, 10:11538 (R;US)
NUCLEAR ATTACKS
See NUCLEAR WEAPONS
NUCLEAR CONTROVERSY
See HUMAN POPULATIONS
NUCLEAR DATA COLLECTIONS
Cross Sections
Simultaneous evaluation of interrelated cross sections by generalized least-squares and related data file requirements, 10:11862 (R;US)

Data Analysis
Simultaneous evaluation of interrelated cross sections by generalized least-squares and related data file requirements, 10:11862 (R;US)

NUCLEAR ENERGY
Classified Information
CG-DAR-1: Guide to the declassified areas of nuclear energy research, 10:12024 (R;US)
Forecasting
Energy and nuclear futures to 2025: an overview, 10:11208 (R;US)
Public Opinion
Public opinion polls on nuclear energy. Analysis of demoscopic findings, 10:11638 (R;DE;In German)
Research Programs
Funding of generic activities within DOE's Office of Assistant Secretary for Nuclear Energy, 10:11075 (R;US)

NUCLEAR EXPLOSIONS
Specifically named single nuclear explosions are listed by name and the word EVENT, e.g., BOXCAR EVENT. All projects involving nuclear explosions are listed by the project name and the word PROJECT, e.g., PLOWSHARE PROJECT.
Global Aspects
Widespread after-effects of nuclear war, 10:11613 (J;GB)

NUCLEAR FACILITIES
See also FUEL FABRICATION PLANTS
NUCLEAR POWER PLANTS
RADIOACTIVE WASTE FACILITIES
Air Pollution Control
Control technology for radioactive emissions to the atmosphere at US Department of Energy facilities, 10:11611 (R;US)
Information Systems
Status of the Graphic Overview System in relation to Department of Energy facilities, 10:11622 (R;US)
Radiation Hazards
Accident-generated radioactive particle source term development for consequence assessment of nuclear fuel cycle facilities, 10:11612 (R;US)
Radiation Monitoring
Status of the Graphic Overview System in relation to Department of Energy facilities, 10:11622 (R;US)
Radioactive Effluents
Control technology for radioactive emissions to the atmosphere at US Department of Energy facilities, 10:11611 (R;US)
Remote Sensing
Comprehensive, integrated, remote sensing at DOE sites, 10:11624 (R;US)

NUCLEAR FUEL ELEMENTS
See FUEL ELEMENTS

NUCLEAR FUELS
Fabrication
Quality assurance in the fabrication of natural uranium nuclear fuels, 10:10961 (RA;DE;In Spanish)
Natural Uranium
Quality assurance in the fabrication of natural uranium nuclear fuels, 10:10961 (RA;DE;In Spanish)
Procurement
Quality assurance and quality control requirements in nuclear fuel procurement in Finland, 10:10958 (RA;DE)
Production
Fuel manufacturing follow at FRAGEMA, 10:10959 (RA;DE)
Statistical evaluation of fuel and fuel assembly production, 10:11101 (RA;DE)
Quality Assurance
Fuel manufacturing follow at FRAGEMA, 10:10959 (RA;DE)
Quality assurance and quality control requirements in nuclear fuel procurement in Finland, 10:10958 (RA;DE)
Quality assurance in the fabrication of natural uranium nuclear fuels, 10:10961 (RA;DE;In Spanish)
Quality Control
Chemical assay as an element of quality control of light water fuels, 10:11085 (RA;DE)
Quality assurance and quality control requirements in nuclear fuel procurement in Finland, 10:10958 (RA;DE)

NUCLEAR MAGNETIC RESONANCE
Bibliographies
NMR studies of fossil fuels. Final technical report, 10:10853 (R;US)
Research Programs
NMR studies of fossil fuels. Final technical report, 10:10853 (R;US)

NUCLEAR MATERIALS MANAGEMENT
Design
International training course on implementation of state systems of accounting for and control of nuclear materials: proceedings, 10:11006 (R;US)
Implementation
International training course on implementation of state systems of accounting for and control of nuclear materials: proceedings, 10:11006 (R;US)
Meetings
International training course on implementation of state systems of accounting for and control of nuclear materials: proceedings, 10:11006 (R;US)

NUCLEAR MATTER
Phase Transformations
Phase transitions in nuclear matter, 10:11893 (R;US)
Solitons
Phase transitions in nuclear matter, 10:11893 (R;US)

NUCLEAR PHYSICS
Use only for indexing articles of very broad coverage, such as annual reviews, text books, etc.
Research Programs
Activities in nuclear and high energy physics, 10:11826 (R;NL;In Dutch)
Experiments on the TASS and HISS spectrometers at the Bevalac. Annual progress report, April 1, 1984-March 31, 1985, 10:11875 (R;US)

NUCLEAR POWER
Forecasting
Nuclear power in the Western World to 2020, 10:11209 (R;GB)

NUCLEAR POWER PLANTS
Cooling Systems
Application of zone-matching methodology to interacting submerged multiport diffusers, 10:11123 (R;US)
Crack Propagation
CSNI specialist meeting on leak-before-break in nuclear reactor piping: proceedings, 10:11167 (R;US)
Loss of Coolant
CSNI specialist meeting on leak-before-break in nuclear reactor piping: proceedings, 10:11167 (R;US)
Maintenance
Decontamination pays off for nuke owners, 10:11089 (J;US)
Pipe Fittings
Seismic stress fields for nuclear elbows using toroidal elasticity theory, 10:11121 (R;US)
Planning
Commercial Nuclear Power 1984: prospects for the United States and the World, 10:11074 (R;US)
Power Generation
Commercial Nuclear Power 1984: prospects for the United States and the World, 10:11074 (R;US)
Pressure Vessels
Seismic stress fields for nuclear elbows using toroidal elasticity theory, 10:11121 (R;US)
Primary Coolant Circuits
CSNI specialist meeting on leak-before-break in nuclear reactor piping: proceedings, 10:11167 (R;US)
Pumps
Estimating common cause failure rates for pumps in nuclear reactors, 10:11076 (R;US)
Reactor Safety
Management weaknesses affect Nuclear Regulatory Commission efforts to address safety issues common to nuclear power plants, 10:11115 (R;US)

NUCLEAR POWER STATIONS
See NUCLEAR POWER PLANTS

NUCLEAR REACTORS
See REACTORS

NUCLEAR SPIN RESONANCE
See NUCLEAR MAGNETIC RESONANCE
NUCLEAR THEORY
Research Programs
Progress in research, November 1, 1983-October 31, 1984, 10:11887 (R;US)
Research in theoretical nuclear physics. Progress report, February 1, 1984-October 31, 1984, 10:11888 (R;US)
NUCLEAR WASTES
See RADIOACTIVE WASTES
NUCLEAR WEAPON TESTS
See NUCLEAR EXPLOSIONS
NUCLEAR WEAPONS
Environmental Impacts
Effects of interactive transport and scavenging of smoke on the calculated temperature change resulting from large amounts of smoke, 10:11597 (R;US)
Proliferation
Energy and nuclear futures to 2025: an overview, 10:11208 (R;US)
NUCLEI
See also HEAVY NUCLEI
Supersymmetry
Nuclear dynamical supersymmetry, 10:11895 (J;US)
NUCLEON-NUCLEON INTERACTIONS
Elastic Scattering
Nucleon-nucleon interaction at medium energies, 10:11865 (R;US)
Inelastic Scattering
Nucleon-nucleon interaction at medium energies, 10:11865 (R;US)
NUCLEONS
See also NEUTRONS
PROTONS
Decay
Experimental limits on the nucleon lifetime for two- and three-body decay modes, 10:11828 (J;US)
Four-Body Problem
Dynamical basis generation method with an application to the four-nucleon problem, 10:11894 (J;US)
NUTS (MECHANICAL)
See FASTENERS

O

OAK RIDGE GASEOUS DIFFUSION PLANT
See ORGDP
OAK RIDGE NATIONAL LABORATORY
See ORNL
OAK RIDGE RESERVATION
Geology
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 8, Appendix H: geology, 10:11198 (R;US)
Hydrology
Geohydrologic characterization of proposed Solid Waste Storage Area (SWSA) 7, 10:10978 (R;US)
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 10, Appendix J: hydrology, 10:11200 (R;US)
Site characterization of the West Chestnut Ridge site, 10:10977 (R;US)
Lithology
Geohydrologic characterization of proposed Solid Waste Storage Area (SWSA) 7, 10:10978 (R;US)
Management
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 1. Management plan overview and summary, 10:11191 (R;US)
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 3, Appendix B: archaeological considerations, 10:11193 (R;US)
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 4, Appendix D: endangered and threatened plant species, 10:11194 (R;US)
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 5, Appendix E: environmental monitoring, 10:11195 (R;US)
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 6, Appendix F: forest management, 10:11196 (R;US)
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 7, Appendix G: geography, demography, topography, and soils, 10:11197 (R;US)
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 15, Appendix P: waste management, 10:11205 (R;US)
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 16, Appendix Q: wildlife management, 10:11206 (R;US)
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 17. Maps, 10:11207 (R;US)
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 12, Appendix L: laws, regulations, and guidelines, 10:11202 (R;US)
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 11, Appendix K: site development, 10:11201 (R;US)
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 10, Appendix J: hydrology, 10:11200 (R;US)
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 9, Appendix I: health, safety, and environmental affairs, 10:11199 (R;US)
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 8, Appendix H: geology, 10:11198 (R;US)
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 2, Appendix A: aquatic habitats, 10:11192 (R;US)
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 14, Appendix O: utilities, 10:11204 (R;US)
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 13, Appendix M: Oak Ridge National Environmental Research Park, 10:11203 (R;US)
Maps
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 17. Maps, 10:11207 (R;US)
Radioactive Waste Disposal
Radionuclide migration pathways analysis for the Oak Ridge Central Waste Disposal Facility on the West Chestnut Ridge site, 10:11002 (R;US)
Radioactive Waste Facilities
Radionuclide migration pathways analysis for the Oak Ridge Central Waste Disposal Facility on the West Chestnut Ridge site, 10:11002 (R;US)
Site characterization of the West Chestnut Ridge site, 10:10977 (R;US)
Soils
Characterization of soils at proposed Solid Waste Storage Area (SWSA) 7, 10:11625 (R;US)
Stratigraphy
Geohydrologic characterization of proposed Solid Waste Storage Area (SWSA) 7, 10:10978 (R;US)
Waste Management
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 15, Appendix P: waste management, 10:11205 (R;US)
OCEAN THERMAL POWER PLANTS
Optimization
Thermoeconomic optimizarion of OC-OTEC electricity and water production plants. Final report, 10:11050 (R;US)

OFF-GAS SYSTEMS
Air Filters
Parametric investigations on the retention of methyl iodide by a KI-impregnated activated carbon, 10:11124 (R;DE;In German)
OFFICE BUILDINGS
Design
168 proof?, 10:11295 (J;US)
Energy design of office buildings, 10:11298 (J;US)
Energy Conservation
168 proof?, 10:11295 (J;US)
Energy design of office buildings, 10:11298 (J;US)
OFFSHORE DRILLING
Environmental Impact Statements
Draft environmental impact statement: proposed oil and gas lease sales 94, 98, and 102 (Gulf of Mexico region), 10:11639 (R;US)
OIL FIELDS
Environmental Impacts
Seasonal abundance and habitat use patterns of shorebirds at two sites in northern Alaska, 10:11640 (J;GB)
Production
Volume and area of oil fields and their impact on order of discovery, 10:10934 (R;US)
OIL SHALE WASTE WATER
See OIL SHALES
WASTE WATER
OIL SHALES
In-Situ Retorting
BX In Situ Oil Shale Project. Environmental Mitigation and Monitoring Plan (revised September 1981), 10:10955 (R;US)
Nuclear Magnetic Resonance
NMR studies of fossil fuels. Final technical report, 10:10853 (R;US)
OIL WELLS
Carbon Dioxide Injection
Mobility control for CO_2 injection (support for field project). Fourteenth quarterly report including project status report, August 17-November 17, 1984, 10:10937 (R;US)
Fluid Injection
Commercial scale demonstration enhanced oil recovery by micellar-polymer flood. Technical progress report, November 1984, 10:10936 (R;US)
Microemulsion Flooding
Commercial scale demonstration enhanced oil recovery by micellar-polymer flood. Technical progress report, November 1984, 10:10936 (R;US)
OLEIC ACID
Biological Effects
Potentiating effects of oxygen in lungs damaged by methylcyclopentadienyl manganese tricarbonyl, cadmium chloride, oleic acid, and antitumor drugs, 10:11693 (J;US)
OLIVINE
Carbon
Carbon abundances in mantle minerals determined by nuclear reaction analysis, 10:11721 (J;US)
OLIVINES
See OLIVINE
ONCOGENIC TRANSFORMATIONS
Radioinduction
Possible error-prone repair of neoplastic transformation induced by fission-spectrum neutrons, 10:11671 (R;US)
ON-LINE COMPUTERS
See COMPUTERS
ON-SITE POWER GENERATION
Fuel Cells
Energy conservation by on-site fuel cells, 10:11232 (RA;US)
Progress in on-site fuel cell technology development, 10:11233 (RA;US)
OPTICAL PUMPING
Helical Waveguides
Optical pumping in a whispering mode optical waveguide, 10:11502 (P;US)
ORGANIC ACIDS
Excluding NUCLEIC ACIDS and NUCLEOTIDES.
See also HUMIC ACIDS
SULFONIC ACIDS
Ion Exchange Chromatography
Selectivity variations in anion chromatography, 10:11428 (R;US)
ORGANIC COMPOUNDS
See also ALDEHYDES
AROMATICS
CARBOHYDRATES
HETEROCYCLIC COMPOUNDS
ORGANIC ACIDS
ORGANIC NITROGEN COMPOUNDS
ORGANIC PHOSPHORUS COMPOUNDS
PROTEINS
Electron Spin Resonance
Electronic properties of new organic conductors ((BEDT-TTF)$_2$BrO$_4$, (BEDT-TTF)$_2$I$_3$), 10:11411 (R;US)
Energy Transfer
Nonclassical behavior of energy transfer from molecules to metal surfaces: Biacetyl(^{3}nπ^*)/Ag(111), 10:11775 (J;US)
Energy-Level Transitions
Nonclassical behavior of energy transfer from molecules to metal surfaces: Biacetyl(^{3}nπ^*)/Ag(111), 10:11775 (J;US)
Environmental Transport
Organics contamination of groundwater: an open literature review, 10:11633 (R;US)
Nuclear Magnetic Resonance
Electronic properties of new organic conductors ((BEDT-TTF)$_2$BrO$_4$, (BEDT-TTF)$_2$I$_3$), 10:11411 (R;US)
Phase Diagrams
Prediction of solid + liquid equilibrium diagrams for binary mixtures forming solid solutions with an extremum, 10:11379 (J;US)
Radiationless Decay
Nonclassical behavior of energy transfer from molecules to metal surfaces: Biacetyl(^{3}nπ^*)/Ag(111), 10:11775 (J;US)
Superconductivity
Electronic properties of new organic conductors ((BEDT-TTF)$_2$BrO$_4$, (BEDT-TTF)$_2$I$_3$), 10:11411 (R;US)
ORGANIC NITROGEN COMPOUNDS
Excluding PROTEINS, AMINES, ALKALOIDS, AMINO ACIDS, NUCLEIC ACIDS, and NUCLEOTIDES.
See also GUANIDINES
NITRO COMPOUNDS
NITROSO COMPOUNDS
Gas Chromatography
Studies of cation exchange for the isolation and concentration of trace level components of complex aqueous mixtures, 10:10974 (R;US)
Ion Exchange
Studies of cation exchange for the isolation and concentration of trace level components of complex aqueous mixtures, 10:10974 (R;US)
ORGANIC PHOSPHORUS COMPOUNDS
Excluding NUCLEIC ACIDS and NUCLEOTIDES.
Uses
Bifunctional organophosphorus liquid-liquid extraction reagents: development and applications, 10:11464 (R;US)
ORGANIC SOLVENTS
Chemical Composition
Process-related effects on chemical composition of direct coal liquefaction materials, 10:10862 (R;US)
Recycling
Process-related effects on chemical composition of direct coal liquefaction materials, 10:10862 (R;US)
ORGANIC WASTES
Anaerobic Digestion
Crab waste methane digester. Final report, 10:11014 (R;US)
ORGDP
Environmental Impacts
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 11, Appendix K: site development, 10:11201 (R;US)
ORNL
Environmental Impacts
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 11, Appendix K: site development, 10:11201 (R;US)

ORNL-PCA REACTOR
Reactor Operation
Bulk Shielding Facility quarterly report, April, May and June 1984, 10:11136 (R;US)
ORYZA
See RICE
OSCILLATION MODES
Coupling
Fourier transform methods for calculating action variables and semiclassical eigenvalues for coupled oscillator systems, 10:11786 (J;US)
OSCILLATIONS (PLASMA)
See PLASMA WAVES
OSCILLATORS
Design
Reinjection laser oscillator and method, 10:11505 (P;US)
OUTER CONTINENTAL SHELF
See CONTINENTAL SHELF
OVERBURDEN
Rock Mechanics
Coal overburden project, 10:10898 (R;AU)
OXIDANTS
See OXIDIZERS
OXIDASES
See OXIDOREDUCTASES
OXIDES
See also ALUMINIUM OXIDES
BARIUM OXIDES
CERIUM OXIDES
CHROMIUM OXIDES
EUROPIUM OXIDES
IRON OXIDES
LANTHANUM OXIDES
LEAD OXIDES
LITHIUM OXIDES
MAGNESIUM OXIDES
NEODYMIUM OXIDES
NITROGEN OXIDES
PLUTONIUM OXIDES
POTASSIUM OXIDES
PRASEODYMIUM OXIDES
RHENIUM OXIDES
RHODIUM OXIDES
SILICON OXIDES
SODIUM OXIDES
TITANIUM OXIDES
URANIUM OXIDES
ZIRCONIUM OXIDES
Quantum Electronics
Application of quantum chemistry of atmospheric chemistry. Annual report, 1 October 1983-30 September 1984, 10:11438 (R;US)
OXIDIZERS
Chemical Reactions
Synthesis and reactivity of heterodinuclear iron, ruthenium, and cobalt compounds containing bridging dithiomethylene ligands. Attempted synthesis of the iron carbyne compound $Cp(CO)FeCSCH_3$, 10:11461 (R;US)
OXIDIZING AGENTS
See OXIDIZERS
OXIDOREDUCTASES
Code number 1.
Inactivation
Alcohol dehydrogenase and an inactivator from rice seedlings, 10:11644 (J;US)
Alcohol dehydrogenase inactivator from rice seedlings: properties and intracellular location, 10:11645 (J;US)
OXYGEN
Adducts
Thermal electron attachment to van der Waals molecules containing O_2, 10:11452 (J;US)
Biological Effects
Effects of O_2 concentration on rice seedlings, 10:11696 (J;US)
Chemisorption
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 4, July-September 1984, 10:11459 (R;US)
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 3, April-June 1984, 10:11460 (R;US)
Diffusion
Oxygen diffusion in uranium oxide: an overview, 10:11402 (J;CH)
Electron Attachment
Thermal electron attachment to van der Waals molecules containing O_3, 10:11452 (J;US)
Response Modifying Factors
Potentiating effects of oxygen in lungs damaged by methylcyclopentadienyl manganese tricarbonyl, cadmium chloride, oleic acid, and antitumor drugs, 10:11693 (J;US)
Self-Diffusion
Coupled diffusion phenomena. Final report (In a commercial soda-lime-silica and $20K_2O$-$20SrO$-$60SiO_2$), 10:11392 (R;US)
Thermochemical Diagrams
Thermochemical modeling of the plutonium and uranium-plutonium dioxides, 10:11440 (R;US)
OXYGEN 16 REACTIONS
Precompound-Nucleus Emission
Precompound limits of linear momentum transfer in heavy ion reactions, 10:11874 (J;US)
OXYGEN EFFECT (RADIOBIOLOGY)
See OXYGEN
OXYGEN HYDRIDES
See WATER
OXYMETHYLENE
See FORMALDEHYDE

P

P WAVES (SEISMIC)
See SEISMIC P WAVES
PACIFIC OCEAN
See also GULF OF ALASKA
Continental Shelf
Shelfbreak circulation, fronts and physical oceanography: east and west coast perspectives, 10:11730 (J;US)
PAH
See POLYCYCLIC AROMATIC HYDROCARBONS
PALAU ISLANDS
See TRUST TERRITORY OF THE PACIFIC ISLANDS
PALLADIUM
Catalytic Effects
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 4, July-September 1984, 10:11459 (R;US)
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 3, April-June 1984, 10:11460 (R;US)
Sorptive Properties
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 4, July-September 1984, 10:11459 (R;US)
PALLADIUM ALLOYS
Electronic Structure
First principles theory of Fermi-surface driven concentration waves in Cu/sub c/Pd/sub 1-c/ alloys, 10:11328 (R;US)
Neutron Diffraction
Paramagnetic scattering from a cubic ferromagnet Pd_2MnSn, 10:11354 (J;US)
Order-Disorder Transformations
First principles theory of Fermi-surface driven concentration waves in Cu/sub c/Pd/sub 1-c/ alloys, 10:11328 (R;US)
PARALLEL PROCESSING
Efficiency
Impact of scalar performance on vector and parallel processors, 10:12014 (R;US)
PARAMAGNETIC RESONANCE (NUCLEAR)
See NUCLEAR MAGNETIC RESONANCE
PARTIAL DIFFERENTIAL EQUATIONS
Finite Difference Method
Fourier method for three-dimensional partial differential equations in periodic geometry. Application: HELIAC, 10:11985 (J;US)

Iterative Methods
Preconditioning by incomplete block cyclic reduction, 10:12021 (J;US)

PARTICLE INTERACTIONS
See also HADRON-HADRON INTERACTIONS
PHOTON-PHOTON INTERACTIONS

Diffraction Models
Diffraction: what do we know; what can we learn, 10:11834 (R;US)

PARTICULATES
Prior to September 1981, this concept was indexed to PARTICLES and AEROSOLS.

Brownian Movement
Application of photon correlation spectroscopy to flowing Brownian motion systems, 10:11807 (J;US)

Classification
Study of deposition control using transpiration. Technical progress report, 10:11525 (R;US)

Combustion
Synthetic chars for studies of char combustion mechanism. Quarterly technical progress report, September 1-December 1, 1984, 10:10925 (R;US)

Deposition
Study of deposition control using transpiration. Technical progress report, 10:11525 (R;US)

Light Scattering
Application of photon correlation spectroscopy to flowing Brownian motion systems, 10:11807 (J;US)

Lung Clearance
Lund clearance of neutron-activated Mount St. Helens volanic ash in the rat, 10:11688 (J;US)

Removal
Evaluation of particulate collection devices developed for pressurized fluidized-bed combustors as applied to coal gasification processes, 10:10867 (R;US)

Retention
Lund clearance of neutron-activated Mount St. Helens volanic ash in the rat, 10:11688 (J;US)

PARTON MODEL
Report of the Snowmass hadronization group, 10:11833 (R;US)

PASSIVE SOLAR HEATING SYSTEMS

Latent Heat Storage
Overview of latent storage for passive solar applications, 10:11061 (R;US)

PBF REACTOR
Hydrogen studies during PBF Severe Fuel Damage tests, 10:11145 (R;US)

PCA-ORNL REACTOR
See ORNL-PCA REACTOR

PEACH BOTTOM-2 REACTOR
York County, Pennsylvania, USA

Risk Assessment
Regulatory analyses for severe accident issues: an example, 10:11170 (R;US)

PEAT

Combustion
Emissions of two milled peat fired power plants, 10:10877 (R;FI;In Finnish)

Consumption Rates
Long term use of Finnish peat resources, 10:10888 (R;FI;In Finnish)

Fluidized-Bed Combustion
Emissions of two milled peat fired power plants, 10:10877 (R;FI;In Finnish)

Resource Assessment
Long term use of Finnish peat resources, 10:10888 (R;FI;In Finnish)

Standardized Terminology
Terminology of the characteristics of fuel peat and coal, 10:10854 (R;FI;In Finnish, English, and German)

PEATLANDS
See WETLANDS

PEDIATRICS

Radiology
20. meeting of the Gesellschaft fuer Paediatrische Radiologie. Abstracts, 10:11658 (R;DE;In German)

Ultrasonography
20. meeting of the Gesellschaft fuer Paediatrische Radiologie. Abstracts, 10:11658 (R;DE;In German)

PELLETS (FUEL)
See FUEL PELLETS

PENETRATORS

Heat Treatments
Evaluation and demonstration of the viability of salt bath solution heat treatment for D.U. penetrators. Final report, 10:11480 (R;US)

PEOPLE
See HUMAN POPULATIONS

PEP STORAGE RINGS

Accelerator Facilities
Recent results from PEP, 10:11821 (R;US)

Drift Chambers
Trigger drift chamber for the MKII upgrade at PEP, 10:11544 (R;US)

PERSONNEL
Studies of groups of persons employed in a particular field of endeavor. For studies on individuals in a group see also MAN.
See also ASTRONAUTS
CRAFTSMEN

Education
Questions/problems of QA/QC personnel training and qualification in developing countries, 10:11112 (RA;DE)

Radiation Doses
Consequence analysis of a hypothetical contained criticality accident in the Hanford Critical Mass Laboratory, 10:11168 (R;US)

PETRA STORAGE RING

Data Processing
Use of MC68000 microprocessors in the TASSO experiment, 10:11556 (R;DE)

Drift Chambers
TASSO vertex detector, 10:11557 (R;DE)

PETROLEUM
Limited to crude oil; see also COAL LIQUIDS, SHALE OIL, etc.

Cost
Replacement cost of domestic crude oil, 10:10940 (R;US)

Deregulation
Effects of oil deregulation on public transportation. Final report, 10:11213 (R;US)

Economic Analysis
Replacement cost of domestic crude oil, 10:10940 (R;US)

Enhanced Recovery
Contracts for field projects and supporting research on enhanced oil recovery. Progress Review No. 39, quarter ending June 30, 1984, 10:10935 (R;US)
Energy production research, Volume I. Monthly progress report for November 1984, 10:10938 (R;US)

Prices
Indonesian oil and gas, 10:11216 (R;US)

Production
Commercial scale demonstration enhanced oil recovery by micellar-polymer flood. Technical progress report, November 1984, 10:10936 (R;US)
Indonesian oil and gas, 10:11216 (R;US)

Reserves
Indonesian oil and gas, 10:11216 (R;US)
Replacement cost of domestic crude oil, 10:10940 (R;US)

Transport
Disaggregating regional energy supply/demand and flow data to 173 BEAs in support of the national energy transportation study. Final report (In USA by pipeline, rail, truck and barge; potential bottlenecks between 1955 to 1995), 10:11210 (R;US)

PETROLEUM COKE
See COKE
PETROLEUM PRODUCTS

PETROLEUM DEPOSITS
See also OIL FIELDS

Leasing
Proposed Gulf of Alaska/Cook Inlet lease sale 88. Final environmental impact statement. Volume 1, 10:10943 (R;US)

Proposed Gulf of Alaska/Cook Inlet lease sale 88. Final environmental impact statement. Volume 2. Appendices, 10:10944 (R;US)
Offshore Drilling
Draft environmental impact statement: proposed oil and gas lease sales 94, 98, and 102 (Gulf of Mexico region), 10:11639 (R;US)
PETROLEUM INDUSTRY
Contracts
Indonesian oil and gas, 10:11216 (R;US)
Economic Analysis
Indonesian oil and gas, 10:11216 (R;US)
PETROLEUM PRODUCTS
See also DIESEL FUELS
FUEL OILS
GASOLINE
Deregulation
Effects of oil deregulation on public transportation. Final report, 10:11213 (R;US)
Sales
Petroleum Marketing Monthly, October 1984, 10:10941 (R;US)
Transport
Disaggregating regional energy supply/demand and flow data to 173 BEAs in support of the national energy transportation study. Final report (In USA by pipeline, rail, truck and barge; potential bottlenecks between 1955 to 1995), 10:11210 (R;US)
PETROLEUM REFINERIES
Occupational Diseases
Cancer risk among oil-refinery workers: a review of epidemiologic studies, 10:10939 (J;US)
PETTEN HIGH FLUX REACTOR
See HFR REACTOR
PHAGES
See BACTERIOPHAGES
PHASE TRANSFORMATIONS
Potentials
Absolute minimum of Landau's thermodynamic potential, 10:11907 (J;US)
Thermodynamics
Absolute minimum of Landau's thermodynamic potential, 10:11907 (J;US)
PHENOL
Mutagenesis
Cytotoxicity and mutagenicity of vapor-phase pollutants in rat lung epithelial cells and Chinese hamster ovary cells grown on collagen gels, 10:11697 (J;US)
Toxicity
Cytotoxicity and mutagenicity of vapor-phase pollutants in rat lung epithelial cells and Chinese hamster ovary cells grown on collagen gels, 10:11697 (J;US)
PHENOLS
See also PHENOL
Ion Exchange
Studies of cation exchange for the isolation and concentration of trace level components of complex aqueous mixtures, 10:10974 (R;US)
Ultrafiltration
Study of Micellar-Enhanced Ultrafiltration. Progress report, March 1, 1984-February 28, 1985 (4-tertbutylphenol), 10:11427 (R;US)
PHENYL ETHER
Hydrogenation
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 4, July-September 1984, 10:11459 (R;US)
PHOSPHATE GLASS
Chemical Composition
Lead-iron phosphate glass: a stable storage medium for high-level nuclear waste, 10:10995 (J;US)
Mechanical Properties
Lead-iron phosphate glass: a stable storage medium for high-level nuclear waste, 10:10995 (J;US)
PHOSPHINES
Chemical Reaction Yield
Conversion of allylphosphine to novel diphosphines: synthesis and characterization of CH_2=$CHCH_2P(H)(CH_2)_3PH_2$ and $P[(CH_2)_3]^3P$, 10:11471 (J;GB)
Dimerization
Conversion of allylphosphine to novel diphosphines: synthesis and characterization of CH_2=$CHCH_2P(H)(CH_2)_3PH_2$ and $P[(CH_2)_3]^3P$, 10:11471 (J;GB)
Photolysis
Conversion of allylphosphine to novel diphosphines: synthesis and characterization of CH_2=$CHCH_2P(H)(CH_2)_3PH_2$ and $P[(CH_2)_3]^3P$, 10:11471 (J;GB)
PHOSPHORUS
Oscillator Strengths
H-Division materials physics quarterly report, April-June 1984, 10:11323 (R;US)
PHOSPHORUS FLUORIDES
Chemical Bonds
Bonding and ionization energies of N—F and P—F compounds, 10:11450 (J;US)
Formation Heat
Bonding and ionization energies of N—F and P—F compounds, 10:11450 (J;US)
Ionization Potential
Bonding and ionization energies of N—F and P—F compounds, 10:11450 (J;US)
PHOTODIODES
Performance Testing
Qualification testing of photodiode, semiconductor, silicon 400-2931, 10:11518 (R;US)
PHOTODISINTEGRATION
See PHOTONUCLEAR REACTIONS
PHOTOELECTROCHEMICAL CELLS
Photocurrents
Photoelectrochemical imaging, 10:11577 (J;US)
PHOTOGRAPHIC FILMS
Calibration
Low-energy x-ray response of photographic films. II. Experimental characterization, 10:11575 (J;US)
Photosensitivity
Low-energy x-ray response of photographic films. II. Experimental characterization, 10:11575 (J;US)
Resolution
Low-energy x-ray response of photographic films. II. Experimental characterization, 10:11575 (J;US)
X-Ray Detection
Low-energy x-ray response of photographic films. II. Experimental characterization, 10:11575 (J;US)
PHOTOGRAPHS
See IMAGES
PHOTOMAGNETOELECTRIC EFFECT
See MAGNETIC FIELDS
PHOTON ACTIVATION ANALYSIS
See PHOTONS
PHOTON DETECTION (X-RAY)
See X-RAY DETECTION
PHOTON TRANSPORT
Computer Codes
UPEML: a machine-portable CDC Update emulator, 10:11902 (R;US)
PHOTON-ATOM COLLISIONS
Resonance Fluorescence
Noise in strong laser-atom interactions: Phase telegraph noise, 10:11795 (J;US)
Resonance Scattering
Noise in strong laser-atom interactions: Phase telegraph noise, 10:11795 (J;US)
PHOTON-PHOTON INTERACTIONS
Scattering
Resonances in photon-photon scattering, 10:11842 (R;US)
PHOTONS
Particle Production
Direct photon production in e^+e^- annihilation, 10:11827 (J;US)
PHOTONUCLEAR REACTIONS
Shell Models
Theoretical nuclear reaction and structure studies using kaons and photons. Progress report, 10:11866 (R;US)
PHOTOVOLTAIC CELLS
See also SOLAR CELLS

Design
Strained superlattice, quantum well, multijunction photovoltaic cell, 10:11031 (RA;US)
Efficiency
Characterization of performance loss mechanisms in a concentrating photovoltaic module, 10:11034 (RA;US)
Performance
Characterization of performance loss mechanisms in a concentrating photovoltaic module, 10:11034 (RA;US)
Quantum Efficiency
Strained superlattice, quantum well, multijunction photovoltaic cell, 10:11031 (RA;US)

PHOTOVOLTAIC POWER PLANTS
Economic Analysis
Grid-connected PV systems: How and where they fit, 10:11044 (RA;US)
Feasibility Studies
Grid-connected PV systems: How and where they fit, 10:11044 (RA;US)
Interfaces
Utility interface: can state-of-the-art power conditioners alleviate our concerns?, 10:11048 (RA;US)
Operation
Utility interface: can state-of-the-art power conditioners alleviate our concerns?, 10:11048 (RA;US)
Technology Assessment
Grid-connected PV systems: How and where they fit, 10:11044 (RA;US)

PHOTOVOLTAIC POWER SUPPLIES
Design
50 kW on-site concentrating solar photovoltaic power system. Phase I: design. Final report, 1 June 1978-28 February 1979, 10:11043 (R;US)
Maintenance
Operation and maintenance experience at intermediate-sized photovoltaic projects, 10:11046 (RA;US)
Operating Cost
Operation and maintenance experience at intermediate-sized photovoltaic projects, 10:11046 (RA;US)
Performance
Effects of reflector augmentation on fixed polycrystalline arrays, 10:11047 (RA;US)
Power Conditioning Circuits
Photovoltaic power-conditioning performance evaluation, lessons learned, 10:11045 (RA;US)
Technology Utilization
Federal Photovoltaic Utilization Program. Final report, 10:11042 (R;US)

PHWR TYPE REACTORS
Fuel Elements
Experiences in the application of quality control and quality assurance programmes in water reactor fuel fabrication, 10:11110 (RA;DE)
Quality control and performance of PHWR fuel in India, 10:11111 (RA;DE)
Quality Assurance
Questions/problems of QA/QC personnel training and qualification in developing countries, 10:11112 (RA;DE)
Quality Control
Questions/problems of QA/QC personnel training and qualification in developing countries, 10:11112 (RA;DE)

PHYSICS
See also ATOMIC PHYSICS
HIGH ENERGY PHYSICS
NUCLEAR PHYSICS
Research Programs
RLE Progress Report No. 126, 10:11732 (R;US)

PICKET FENCE
See CUSPED GEOMETRIES

PIGE ANALYSIS
See PROTON REACTIONS

PIGMENT CELLS
See ANIMAL CELLS

PINS (FUEL)
See FUEL PINS

PION MINUS REACTIONS
Inelastic Scattering
Pion inelastic scattering to giant resonances and low-lying collective states in ^{118}Sn and ^{40}Ca, 10:11878 (J;US)

PION PLUS REACTIONS
Inelastic Scattering
Pion inelastic scattering to giant resonances and low-lying collective states in ^{118}Sn and ^{40}Ca, 10:11878 (J;US)

PION-NUCLEON INTERACTIONS
Pair Production
Particle detector performance in a Fermilab experiment (E-615 detector), 10:11548 (R;US)

PIONS MINUS
Particle Production
Inclusive pion production in 330, 400, and 500 MeV proton-nucleus collisions, 10:11870 (J;US)

PIONS PLUS
Particle Production
Inclusive pion production in 330, 400, and 500 MeV proton-nucleus collisions, 10:11870 (J;US)

PIPE FITTINGS
Stress Analysis
Seismic stress fields for nuclear elbows using toroidal elasticity theory, 10:11121 (R;US)

PIPELINES
Cost
High temperature gas reactor and energy pipeline system, 10:11178 (J;ZZ)
Design
High temperature gas reactor and energy pipeline system, 10:11178 (J;ZZ)

PIPES
Crack Propagation
Proceedings: second seminar on countermeasures for pipe cracking in BWRs. Volume 2. Remedy development, 10:11077 (R;US)
Stress Corrosion
Proceedings: second seminar on countermeasures for pipe cracking in BWRs. Volume 2. Remedy development, 10:11077 (R;US)

PITTING CORROSION
Local electrochemistry of pitting corrosion in stainless steels, 10:11325 (R;US)

PITTSBURG-MIDWAY SOLVENT REFINED COAL PRO
See SRC PROCESS

PLANTS
See also ALGAE
GRASS
SHRUBS
VEGETABLES
WATER HYACINTHS
Inventories
Northern Plant Documentation Center, 1980-1983. Final report, 10:11615 (R;US)

PLANTS (INDUSTRIAL)
See INDUSTRIAL PLANTS

PLANTS (POWER)
See POWER PLANTS

PLASMA
See also HOMOGENEOUS PLASMA
LASER-PRODUCED PLASMA
Distribution Functions
Fast alpha particle distribution function in an open field-line plasma with electrostatic confining potential, 10:11932 (R;US)
Drift Instability
Effect of Coulomb collisions on universal mode stability, 10:11954 (J;US)
Electric Fields
Differential equation for the ambipolar electric field in a multiple-helicity torsatron, 10:11950 (J;US)
Electron-Ion Collisions
Effect of Coulomb collisions on universal mode stability, 10:11954 (J;US)
Energy Absorption
J x B heating by very intense laser light, 10:11949 (J;US)

Flow Rate
Micro-column plasma emission liquid chromatograph, 10:11580 (P;US)
Flute Instability
Stabilization of interchange modes in mirror plasma devices by radio-frequency sideband coupling, 10:11948 (J;US)
Line Broadening
Static and dynamic shifts of spectral lines, 10:11796 (J;US)
Magnetohydrodynamics
Analytic theory of stable resistive magnetohydrodynamic modes, 10:11955 (J;US)
Nonlinear Problems
Effect of Coulomb collisions on universal mode stability, 10:11954 (J;US)
Nonlinear interaction of tearing modes: A comparison between the tokamak and the reversed field pinch configurations, 10:11953 (J;US)
Plasma Instability
Stabilization of interchange modes in mirror plasma devices by radio-frequency sideband coupling, 10:11948 (J;US)
Plasma Waves
Analytic theory of stable resistive magnetohydrodynamic modes, 10:11955 (J;US)
Spectral Shift
Static and dynamic shifts of spectral lines, 10:11796 (J;US)
Tearing Instability
Nonlinear interaction of tearing modes: A comparison between the tokamak and the reversed field pinch configurations, 10:11953 (J;US)
Turbulence
Effect of Coulomb collisions on universal mode stability, 10:11954 (J;US)

PLASMA CONFINEMENT
See also INERTIAL CONFINEMENT
Technology Assessment
Future technology requirements for magnetic fusion--An evaluation based on conceptual design studies, 10:11989 (J;US)

PLASMA DIAGNOSTICS
Far Infrared Radiation
Far-infrared laser scattering in the ACT-I toroidal device, 10:11944 (R;US)
Gamma Spectra
Fusion gamma diagnostics, 10:11943 (R;US)
Neutron Spectrometers
Proposed 14-MeV neutron spectrometer system for jet, 10:11947 (R;SE)
Time-of-Flight Spectrometers
Proton spectra diagnostics for shock-compression studies, 10:11956 (J;US)

PLASMA HEATING
Laser Radiation
J x B heating by very intense laser light, 10:11949 (J;US)

PLASMA INSTABILITY
Radial structure of curvature-driven instabilities in a hot-electron plasma, 10:11963 (J;US)

PLASMA OSCILLATIONS
See PLASMA WAVES

PLASMA (QUARK)
See QUARK MATTER

PLASMA SHEET
Proton Temperature
Simultaneous observation of the plasma sheet in the near earth and distant magnetotail: ISEE-1 and ISEE-3, 10:11751 (J;US)

PLASMA SWITCHES
Plasma switch development. Final report 26 February 1982-25 February 1984, 10:11516 (R;US)

PLASMA WAVES
Uses
Space-charge wave propagation in inhomogeneous waveguides, 10:11535 (J;US)

PLATINUM
Chemical Bonds
NMR study of the chemisorption bond of carbon monoxide on platinum, 10:11418 (J;US)
Diffusion
Low-temperature ion beam mixing of Pt and Si markers in Ge, 10:11416 (J;US)
Sorptive Properties
NO thermally desorbed from a saturation coverage on Pt(111): Internal state distributions, 10:11445 (J;US)

PLATINUM ALLOYS
Electric Conductivity
Phase stability and magnetic properties of UAl_2 based pseudobinary spin fluctuation compounds, 10:11341 (R;US)
Specific Heat
Phase stability and magnetic properties of UAl_2 based pseudobinary spin fluctuation compounds, 10:11341 (R;US)

PLATINUM COMPOUNDS
Magnetic Susceptibility
Effect of pressure on spin fluctuations and superconductivity in heavy-fermion UPt_3, 10:11357 (J;US)
Superconductivity
Effect of pressure on spin fluctuations and superconductivity in heavy-fermion UPt_3, 10:11357 (J;US)

PLESIOTHERAPY
See RADIOTHERAPY

PLUMES
Diffusion
Evaluation of alternative gaussian plume dispersion modeling techniques in estimating short-term sulfur dioxide concentrations, 10:11590 (R;US)
Field validation of six-particle puff model, 10:11588 (R;US)
Mathematical Models
Analysis of uncertainties in CRAC2 calculations: wet deposition and plume rise, 10:11608 (R;US)

PLUTONIUM
Alpha Spectroscopy
Rapid and precise alpha-particle spectrometry for plutonium materials, 10:11432 (J;NL)
Criticality
Calculated k-effectives for plutonium critical experiments. Consolidated Fuel Reprocessing Program, 10:10963 (R;US)
Gamma Spectroscopy
Assay of plutonium metal by gamma spectrometry and calorimetry, 10:11430 (R;US)
Production
Plutonium metal and alloy preparation by molten chloride reduction, 10:11342 (R;US)
Purification
Plutonium purification by vacuum distillation, 10:11347 (R;US)
Solubility
Groundwater chemistry along flow paths between a proposed repository site and the accessible environment, 10:11000 (R;US)
Tissue Distribution
Distribution of radium and plutonium in human bone, 10:11672 (R;US)

PLUTONIUM 239
Sorption
Influence of basalt/groundwater interactions on radionuclide migration, 10:10998 (R;US)

PLUTONIUM 239 TARGET
Neutron Reactions
Least squares fit of thermal data for fissile nuclei, 10:11881 (R;US)

PLUTONIUM 240
Mass Spectroscopy
Review of applications of mass spectrometry to low level radionuclide metrology, 10:11431 (J;NL)
Radiation Monitoring
Review of applications of mass spectrometry to low level radionuclide metrology, 10:11431 (J;NL)

PLUTONIUM 241 TARGET
Neutron Reactions
Least squares fit of thermal data for fissile nuclei, 10:11881 (R;US)

PLUTONIUM 242
Mass Spectroscopy
Review of applications of mass spectrometry to low level radionuclide metrology, 10:11431 (J;NL)

Radiation Monitoring
Review of applications of mass spectrometry to low level radionuclide metrology, 10:11431 (J;NL)

PLUTONIUM ALLOYS
Production
Plutonium metal and alloy preparation by molten chloride reduction, 10:11342 (R;US)

PLUTONIUM COMPOUNDS
See also PLUTONIUM NITRATES
PLUTONIUM OXIDES
Magnetization
Magnetization density of 5f electrons in ferromagnetic PuSb, 10:11361 (J;US)

PLUTONIUM NITRATES
Denitration
Apparatus for denitration of uranyl nitrate and/or plutonium nitrate, 10:10956 (TG;US)

PLUTONIUM OXIDES
Thermochemical Diagrams
Thermochemical modeling of the plutonium and uranium-plutonium dioxides, 10:11440 (R;US)

PNA
See POLYCYCLIC AROMATIC HYDROCARBONS

POISONS (CHEMICAL)
See HAZARDOUS MATERIALS

POLICY
See ENERGY POLICY

POLLUTANTS
Not for radioactive contaminants for which use RADIOACTIVE WASTES or other related terminology.
Deposition
Treatment of ground deposition, species decay and growth and source height effects in a Lagrangian trajectory model, 10:11605 (J;GB)

POLLUTION CONTROL EQUIPMENT
See also AIR FILTERS
ELECTROSTATIC PRECIPITATORS
Comparative Evaluations
Evaluation of particulate collection devices developed for pressurized fluidized-bed combustors as applied to coal gasification processes, 10:10867 (R;US)

POLYACETYLENES
Energy Levels
Patterns of energy levels and spectra for polyatomic molecules, 10:11799 (J;US)
Hyperfine Structure
Patterns of energy levels and spectra for polyatomic molecules, 10:11799 (J;US)

POLYATOMIC MOLECULES
Energy Levels
Patterns of energy levels and spectra for polyatomic molecules, 10:11799 (J;US)
Hyperfine Structure
Patterns of energy levels and spectra for polyatomic molecules, 10:11799 (J;US)

POLYCYCLIC AROMATIC AMINES
Gas Chromatography
Integrated analytical approach to detailed chemical characterization of coal liquefaction process materials, 10:10861 (R;US)

POLYCYCLIC AROMATIC HYDROCARBONS
Atmospheric Chemistry
Characterization of polycyclic organic matter (POM) from coal-fired power plants in the atmosphere and investigation of their transformation in the atmosphere, 10:10880 (R;DK;In Danish)
Biological Effects
Excision repair of ultraviolet- and chemically-induced damage in the DNA of fibroblasts derived from two closely related species of marine fishes, 10:11701 (J;NL)
Fractionation
Identification of polycyclic aromatic compounds containing two heteroatoms in coal liquids and shale oils. Incremental funding request and annual progress report, December 1, 1983-November 31, 1984 (Hydroxylated two- and three-ring thiophenes, aminodibenzothiophenes and hydroxylated nitrogen heterocycles), 10:10850 (R;US)
Integrated analytical approach to detailed chemical characterization of coal liquefaction process materials (Neutral PAH, cyano-PAH, hydroaromatics), 10:10861 (R;US)
Gas Chromatography
Integrated analytical approach to detailed chemical characterization of coal liquefaction process materials (Neutral PAH, cyano-PAH, hydroaromatics), 10:10861 (R;US)
Process-related effects on chemical composition of direct coal liquefaction materials, 10:10862 (R;US)
Hydrogenation
Coal liquefaction research. Quarterly report, April-June 1984, 10:10849 (R;US)
Mutagen Screening
Identification of polycyclic aromatic compounds containing two heteroatoms in coal liquids and shale oils. Incremental funding request and annual progress report, December 1, 1983-November 31, 1984 (Hydroxylated two- and three-ring thiophenes, aminodibenzothiophenes and hydroxylated nitrogen heterocycles), 10:10850 (R;US)
Integrated analytical approach to detailed chemical characterization of coal liquefaction process materials (Neutral PAH, cyano-PAH, hydroaromatics), 10:10861 (R;US)
Transformation of Syrian hamster embryo cells by synfuel mixtures, 10:11694 (J;US)
Synthesis
Identification of polycyclic aromatic compounds containing two heteroatoms in coal liquids and shale oils. Incremental funding request and annual progress report, December 1, 1983-November 31, 1984 (Hydroxylated two- and three-ring thiophenes, aminodibenzothiophenes and hydroxylated nitrogen heterocycles), 10:10850 (R;US)

POLYCYCLIC SULFUR HETEROCYCLES
Fractionation
Identification of polycyclic aromatic compounds containing two heteroatoms in coal liquids and shale oils. Incremental funding request and annual progress report, December 1, 1983-November 31, 1984, 10:10850 (R;US)
Gas Chromatography
Identification of polycyclic aromatic compounds containing two heteroatoms in coal liquids and shale oils. Incremental funding request and annual progress report, December 1, 1983-November 31, 1984, 10:10850 (R;US)

POLYMER FLOODING
See MICROEMULSION FLOODING
WATERFLOODING

POLYMERS
Protective Coatings
Protection of Lexan from uv radiation by photodownconversion. Final report, 10:11056 (R;US)

POLYNUCLEAR AROMATIC HYDROCARBONS
See POLYCYCLIC AROMATIC HYDROCARBONS

POLYTHIONATES
See SULFUR COMPOUNDS

POLYTHIONIC ACIDS
See SULFUR COMPOUNDS

POMERANCHUK PARTICLES
Particle Structure
Diffraction: what do we know; what can we learn, 10:11834 (R;US)

POMERONS
See POMERANCHUK PARTICLES

POOL BOILING
Heat Transfer
Correlation of local heat flux from inclined volume-heated pools in bubbly flow, 10:11512 (J;US)

POOL CRITICAL ASSEMBLY ORNL
See ORNL-PCA REACTOR

POROUS MATERIALS
Mechanical Properties
Theories of immiscible and structured mixtures, 10:11911 (J;GB)

POSITRON-ELECTRON-PROTON STORAGE RING
See PEP STORAGE RINGS

POSITRONS
Emission
Positron reemission: measurement of thin single crystal W(100) films to be used as transmission moderator or re-moderators, 10:11761 (R;US)
POSTULATED PARTICLES
See also MAGNETIC MONOPOLES
POMERANCHUK PARTICLES
PREONS
QUARKS
Particle Identification
Physics at 10^{34} cm^{-2} s^{-1}, 10:11813 (R;US)
POTASSIUM
Solvent Extraction
Investigations of ion-size-selective synergism in solvent extraction, 10:11433 (J;US)
POTASSIUM 39 TARGET
Neutron Reactions
Resonance neutron capture by ^{39,41}K, 10:11872 (J;US)
POTASSIUM 41 TARGET
Neutron Reactions
Resonance neutron capture by ^{39,41}K, 10:11872 (J;US)
POTASSIUM CHLORIDES
Edge Dislocations
Dislocation charges in pure and Ca^{++}-doped KCl in the temperature range from 82 to 294 K, 10:11426 (J;GB)
POTASSIUM HYDROXIDES
Binding Energy
Characterization of high temperature vapors of import to combustion and gasification processes in the energy technologies. Final report, March 1, 1980-March 1, 1981, 10:10835 (R;US)
Excited States
Characterization of high temperature vapors of import to combustion and gasification processes in the energy technologies. Final report, March 1, 1980-March 1, 1981, 10:10835 (R;US)
Regeneration
Bench scale development of the TRW process for cleaning coal (gravimelt process). Quarterly technical progress report, August-October 1984, 10:10842 (R;US)
Synthesis
Characterization of high temperature vapors of import to combustion and gasification processes in the energy technologies. Final report, March 1, 1980-March 1, 1981, 10:10835 (R;US)
POTASSIUM OXIDES
Binding Energy
Characterization of high temperature vapors of import to combustion and gasification processes in the energy technologies. Final report, March 1, 1980-March 1, 1981, 10:10835 (R;US)
Excited States
Characterization of high temperature vapors of import to combustion and gasification processes in the energy technologies. Final report, March 1, 1980-March 1, 1981, 10:10835 (R;US)
Synthesis
Characterization of high temperature vapors of import to combustion and gasification processes in the energy technologies. Final report, March 1, 1980-March 1, 1981, 10:10835 (R;US)
Thermodynamic Properties
Coupled diffusion phenomena. Final report, 10:11392 (R;US)
POTASSIUM PHOSPHATES
Radiation Effects
Bulk and surface damage thresholds of crystals and glasses at 248 nm, 10:11424 (J;US)
POWDERS
Bonding
Comments on bonding processes during the dynamic compaction of metallic powders, 10:11376 (J;CH)
Compacting
Comments on bonding processes during the dynamic compaction of metallic powders, 10:11376 (J;CH)
POWER BURST FACILITY USAEC
See PBF REACTOR
POWER CONDITIONING CIRCUITS
Performance
Photovoltaic power-conditioning performance evaluation, lessons learned, 10:11045 (RA;US)
POWER DEMAND
Forecasting
DOE's Collins predicts need for 680 plants by 2000, 10:11315 (J;US)
POWER PLANTS
See also DUAL-PURPOSE POWER PLANTS
FUEL CELL POWER PLANTS
THERMAL POWER PLANTS
Construction
DOE's Collins predicts need for 680 plants by 2000, 10:11315 (J;US)
Financing
DOE's Collins predicts need for 680 plants by 2000, 10:11315 (J;US)
POWER POOLS
See INTERCONNECTED POWER SYSTEMS
POWER REACTORS
See also GRAND GULF-1 REACTOR
PEACH BOTTOM-2 REACTOR
SHOREHAM REACTOR
SNR-1 REACTOR
Meltdown
Interaction of hot solid, core debris with concrete, 10:11171 (R;US)
Reactor Accidents
Hydrogen studies during PBF Severe Fuel Damage tests, 10:11145 (R;US)
Regulatory analyses for severe accident issues: an example, 10:11170 (R;US)
Reactor Cores
Interaction of hot solid, core debris with concrete, 10:11171 (R;US)
Reactor Licensing
Operating reactors licensing actions summary. Vol. 4, No. 10, 10:11116 (R;US)
Operating reactors licensing actions summary. Volume 4, No. 11, 10:11117 (R;US)
Reactor Materials
Interaction of hot solid, core debris with concrete, 10:11171 (R;US)
POWER SYSTEMS
Includes electric power networks with associated generating and transmission facilities.
See also DC SYSTEMS
INTERCONNECTED POWER SYSTEMS
Control Systems
Proceedings: parallel processing for power system planning and operations, 10:11066 (R;US)
Electrical Transients
Structure preserving model for power system stability analysis, 10:11073 (J;US)
Load Analysis
Critical review of external network modelling for online security analysis, 10:11071 (J;GB)
Meetings
Proceedings: parallel processing for power system planning and operations, 10:11066 (R;US)
Planning
Proceedings: parallel processing for power system planning and operations, 10:11066 (R;US)
Stability
Structure preserving model for power system stability analysis, 10:11073 (J;US)
PRASEODYMIUM
Crystal Structure
H-Division materials physics quarterly report, April-June 1984, 10:11323 (R;US)
PRASEODYMIUM OXIDES
Crystal Field
Neutron scattering investigation of magnetic excitations at high energy transfers, 10:11389 (R;US)

Magnetic Susceptibility
Neutron scattering investigation of magnetic excitations at high energy transfers, 10:11389 (R;US)
PRECIPITATIONS (ATMOSPHERIC)
See ATMOSPHERIC PRECIPITATIONS
PREONS
Particle Structure
Probing for preon structure via gluons, 10:11840 (R;US)
PRESSURE VESSELS
Dosimetry
LWR Pressure Vessel Surveillance Dosimetry Improvement Program. Semiannual progress report, October 1983-March 1984. Volume 1, 10:11088 (R;US)
Fracture Properties
Fitting curves to toughness data, 10:11514 (J;US)
Impact Tests
Curve fitting impact test data: a statistical procedure, 10:11515 (J;US)
Materials Testing
New series of advanced 3Cr-Mo-Ni steels for thick section pressure vessels in high temperature and pressure hydrogen service. Topical report, February 1, 1982-January 31, 1984, 10:11335 (R;US)
Stress Analysis
Seismic stress fields for nuclear elbows using toroidal elasticity theory, 10:11121 (R;US)
PRESSURIZED HEAVY WATER COOLED MODERATED
See PHWR TYPE REACTORS
PRESSURIZED WATER COOLED MODERATED REACTO
See PWR TYPE REACTORS
PRESSURIZED WATER REACTORS
See PWR TYPE REACTORS
PRESSURIZERS
Valves
Experimental investigation of the performance of pressurizer safety valves during single- and two-phase flow (ATWS). Final report, 10:11163 (R;DE;In German)
PRIMARY COOLANT CIRCUITS
See also COOLANT CLEANUP SYSTEMS
Leak Testing
CSNI specialist meeting on leak-before-break in nuclear reactor piping: proceedings, 10:11167 (R;US)
PROCESS SOLUTIONS
Chemical Composition
Integrated analytical approach to detailed chemical characterization of coal liquefaction process materials, 10:10861 (R;US)
Process-related effects on chemical composition of direct coal liquefaction materials, 10:10862 (R;US)
PROCESSING (WASTES)
See WASTE PROCESSING
PRODUCER GAS
130 to 140 Btu/ft³.
Cleaning
Clean-up of producer and synthesis gas with a tube and wire electrostatic precipitator, 10:11024 (J;GB)
PRODUCTION (HYDROGEN)
See HYDROGEN PRODUCTION
PRODUCTION REACTORS
For the production of fissile materials only; see also IRRADIATION REACTORS.
Coolant Cleanup Systems
Simulation calculations for a catalytic exchange/cryogenic distillation hydrogen isotope separation process, 10:11137 (R;US)
PROGRAM MANAGEMENT
Evaluation
Appropriate Technology Small Grants Program: an evaluation. Volume I. Report, 10:11220 (R;US)
Appropriate Technology Small Grants Program: an evaluation. Volume II. Appendix, 10:11221 (R;US)
PROGRAMMING
Limited to computer programming.
See also PARALLEL PROCESSING
VECTOR PROCESSING
Calculation Methods
Software and its relationship to methods, 10:12016 (R;US)
PROJECT MANAGEMENT
See PROGRAM MANAGEMENT
PROMPT NEUTRONS
Multiplicity
Least squares fit of thermal data for fissile nuclei, 10:11881 (R;US)
PROPAGATION (WAVE)
See WAVE PROPAGATION
PROPANE
Sales
Petroleum Marketing Monthly, October 1984, 10:10941 (R;US)
PROPPING AGENTS
Transport
Proppant transport model. Final report, 10:10950 (R;US)
PROTEINS
Nuclear Magnetic Resonance
Applications of NMR to the dynamics of carbohydrates; simplifying NMR spectra of proteins, 10:11641 (R;US)
Radioimmunoassay
Value of α-fetoprotein determination in infants and a method of determination by RIA, 10:11650 (R;DE;In German)
PROTON REACTIONS
Electromagnetic Interactions
Bremsstrahlung and radiative processes at medium energies, 10:11867 (R;CA)
Inclusive Interactions
Inclusive pion production in 330, 400, and 500 MeV proton-nucleus collisions, 10:11870 (J;US)
PROTON-ANTIPROTON INTERACTIONS
Accelerator Facilities
Design for small angle (0 to 2mr) spectrometer for ep or anti pp collisions at DO, 10:11560 (R;US)
Particle Production
Probing for preon structure via gluons, 10:11840 (R;US)
PROTON-DEUTERON INTERACTIONS
Electromagnetic Interactions
Bremsstrahlung and radiative processes at medium energies, 10:11867 (R;CA)
PROTON-NEUTRON INTERACTIONS
Elastic Scattering
Investigation of the neutron-proton-interaction in the energy range from 20 to 50 MEV, 10:11824 (R;DE;In German)
Nucleon-nucleon interaction at medium energies, 10:11865 (R;US)
Electromagnetic Interactions
Bremsstrahlung and radiative processes at medium energies, 10:11867 (R;CA)
PROTON-PROTON INTERACTIONS
Cross Sections
Measurements of spin-correlation parameters A/sub L/L and A/sub S/L for pp→πd between 500 and 800 MeV, 10:11829 (J;US)
Elastic Scattering
Nucleon-nucleon interaction at medium energies, 10:11865 (R;US)
Electromagnetic Interactions
Bremsstrahlung and radiative processes at medium energies, 10:11867 (R;CA)
Particle Production
Physics at 10^{34} cm^{-2} s^{-1}, 10:11813 (R;US)
Study of charm production in proton-proton interactions at $\sqrt{s}$ = 62 GeV with a forward K^- trigger, 10:11823 (R;US)
PROTONS
Diffusion
Diffusion of deuterium and hydrogen in rutile TiO_2 crystals at low temperatures, 10:11398 (J;US)
Energy Losses
Monte Carlo calculation of energy deposition and ionization yield for high energy protons, 10:11901 (R;US)
Particle Decay
Gauge theories, massive neutrinos, and proton decay, 10:11812 (B;US)

Weak Particle Decay
Data preprocessor and compactor for the Soudan 2 nucleon decay experiment, 10:11558 (R;US)

PSORALEN
Photochemical Reactions
Mechanisms of photosensititization by furocoumarins, 10:11686 (R;US)

PSORIASIS
Cell Proliferation
Autoradiographical in-vitro examination of the cell proliferation of persisting psoriatic plaques in preferred areas under therapy with ultraviolet light: Photochemotherapy (PUVA) and selective ultraviolet phototherapy (SUP), 10:11654 (R;DE;In German)
Radiotherapy
Autoradiographical in-vitro examination of the cell proliferation of persisting psoriatic plaques in preferred areas under therapy with ultraviolet light: Photochemotherapy (PUVA) and selective ultraviolet phototherapy (SUP), 10:11654 (R;DE;In German)

PULMONARY LAVAGE
See LUNGS

PULVERIZATION
See COMMINUTION

PULVERIZED FUEL ASH
See FLY ASH

PUMPS
System Failure Analysis
Estimating common cause failure rates for pumps in nuclear reactors, 10:11076 (R;US)
Temperature Monitoring
Primary coolant pump measurement for ICC trend analysis, 10:11093 (R;US)

PWR TYPE REACTORS
See also LOFT REACTOR
After-Heat Removal
Energy-supply-independent after-heat removal in nuclear propulsion plants for ships in combination with sinking and cantering, 10:11098 (R;DE;In German)
ATWS
Experimental investigation of the performance of pressurizer safety valves during single- and two-phase flow (ATWS). Final report, 10:11163 (R;DE;In German)
Cesium
Significance of cesium in LMFBR and LWR safety analysis, 10:11164 (R;DE)
Corrosive Effects
Workshop proceedings: pitting in steam generator tubing, 10:11095 (R;US)
Fuel Assemblies
Experience with quality assurance in fuel design and manufacturing, 10:11100 (RA;DE)
Methods for QC fuel assemblies, 10:11084 (RA;DE)
QA/QC for nuclear fuel fabrication at ASEA-Atom, Sweden, 10:11082 (RA;DE)
Surveillance by EDF of PWR fuel assembly fabrication, 10:11103 (RA;DE;In French)
Fuel Cans
Computerized ultrasonic tube testing systems with special reference to the installation in tube mills for nuclear tubing of fuel fabrication facilities, 10:11106 (RA;DE)
Methods of quality control for Zircaloy tubing, 10:11105 (RA;DE)
Statistical methods in the quality control of UO_2 pellets and Zircaloy cladding tubes for water-reactor fuel rods, 10:11081 (RA;DE)
Fuel Cycle
Environmental assessment: DOE program to improve uranium utilization in light water reactors, 10:11125 (R;US)
Fuel Elements
Economic consequences of QA and QC in fuel and fuel assembly production, 10:11078 (RA;DE)
Performance-related characteristics of water reactor fuel - an update, 10:11087 (RA;DE)
Practical experience in the application of quality control in water-reactor fuel fabrication, 10:11099 (R;DE)
Role of the governmental authority in LWR fuel fabrication QA activities in Brazil, 10:11080 (RA;DE)
Statistical evaluation of fuel and fuel assembly production, 10:11101 (RA;DE)
Technology and performance of water reactor fuel, 10:11079 (RA;DE)
Fuel Pellets
Statistical methods in the quality control of UO_2 pellets and Zircaloy cladding tubes for water-reactor fuel rods, 10:11081 (RA;DE)
Fuel Rods
Measurement of the inner pressure of a fuel rod and determination of the filling gas purity, 10:11086 (RA;DE)
Level Indicators
Heated thermocouple liquid level system, 10:11122 (R;US)
Levels
High temperature, high pressure water level sensor, 10:11090 (R;US)
Loss of Coolant
Ability of the TRAC-P1A computer program to predict blowdown, refill, and reflood phenomena during Semiscale Mod-1 experiments, 10:11153 (R;US)
Development of a cooled coaxial low flow velocimeter, 10:11148 (R;US)
Experimental verification of the behavior of surface flaws in thick-walled steel cylinders during severe thermal shock, 10:11149 (R;US)
Potential for interactive/real time nuclear power plant simulation with RELAP5, 10:11144 (R;US)
Meltdown
Analysis of ex-vessel debris/water interaction and a potential overpressurization of containment, 10:11139 (R;US)
Preliminary observation of large scale UO_2 melt-concrete interactions and sustained steel-concrete interaction with an overlying water pool, 10:11173 (R;US)
Mixed Oxide Fuels
Fabrication and quality control of mixed oxide LWR fuel with regard to homogeneity of fissile content, 10:11083 (RA;DE)
Nuclear Fuels
Chemical assay as an element of quality control of light water fuels, 10:11085 (RA;DE)
Statistical evaluation of fuel and fuel assembly production, 10:11101 (RA;DE)
Nuclear Ships
Energy-supply-independent after-heat removal in nuclear propulsion plants for ships in combination with sinking and cantering, 10:11098 (R;DE;In German)
Pressure Vessels
LWR Pressure Vessel Surveillance Dosimetry Improvement Program. Semiannual progress report, October 1983-March 1984. Volume 1, 10:11088 (R;US)
Primary Coolant Circuits
CSNI specialist meeting on leak-before-break in nuclear reactor piping: proceedings, 10:11167 (R;US)
Pumps
Estimating common cause failure rates for pumps in nuclear reactors, 10:11076 (R;US)
Primary coolant pump measurement for ICC trend analysis, 10:11093 (R;US)
Radioactive Aerosols
Aerosol instrumentation for the Marviken aerosol transport tests, 10:11131 (J;GB)
Reactor Accidents
BEAGL-01: a computer code for calculating rapid LWR core transients. Volume 2. User's manual, 10:11160 (R;US)
Behavior of core debris ejected from a pressurized vessel into scaled reactor cavities, 10:11172 (R;US)
Frequency distributions of activity concentrations after accidential releases of radionuclides, 10:11165 (R;DE;In German)
RETRAN-02: a program for Transient Thermal-hydraulic Analysis of Complex Fluid Flow Systems. Volume 3. User's manual. Revision 2, 10:11174 (R;US)
RETRAN-02: a program for Transient Thermal-hydraulic Analysis of Complex Fluid Flow systems. Volume 2. Programmer's manual. Revision 2, 10:11175 (R;US)

Reactor Cells
Moderization of the LEOPARD library, 10:11092 (R;BR;In Portuguese)
Reactor Instrumentation
High temperature, high pressure water level sensor, 10:11090 (R;US)
Reactor Kinetics
Moderization of the LEOPARD library, 10:11092 (R;BR;In Portuguese)
Reactor Safety
Reports of reactor safety research projects sponsored by the Federal Ministry for Research and Technology (BMFT), 10:11161 (R;DE;In German)
Significance of cesium in LMFBR and LWR safety analysis, 10:11164 (R;DE)
Risk Assessment
Frequency distributions of activity concentrations after accidential releases of radionuclides, 10:11165 (R;DE;In German)
Steam Generators
Evaluation of alternative alloys for PWR steam generator tubing. Final report, 10:11096 (R;US)
Generation and behavior of metal oxide colloids in PWR steam systems, 10:11097 (R;US)
Workshop proceedings: pitting in steam generator tubing, 10:11095 (R;US)
Thermocouples
Thermocouple modeling, 10:11094 (R;US)
Transients
BEAGL-01: a computer code for calculating rapid LWR core transients. Volume 2. User's manual, 10:11160 (R;US)
RETRAN-02: a program for Transient Thermal-hydraulic Analysis of Complex Fluid Flow Systems. Volume 3. User's manual. Revision 2, 10:11174 (R;US)
RETRAN-02: a program for Transient Thermal-hydraulic Analysis of Complex Fluid Flow systems. Volume 2. Programmer's manual. Revision 2, 10:11175 (R;US)

PYRENE
Hydrogenation
Coal liquefaction research. Quarterly report, April-June 1984, 10:10849 (R;US)

PYRITE
Oxidation
Desulfurization of coal slurries by electrolysis, 10:10909 (RA;US)
Removal
Coal cleaning by froth flotation, 10:10913 (R;US)

PYRITES
See PYRITE

Q

QUALITY ASSURANCE
Regression Analysis
Curve fitting impact test data: a statistical procedure, 10:11515 (J;US)

QUANTUM CHROMODYNAMICS
Chiral Symmetry
QCD chiral-symmetry breaking in a Rayleigh-Ritz variational calculation, 10:11856 (J;US)
Coupling Constants
Some comments on α/sub s/ and Λ/sub anti MS/, 10:11841 (R;US)
Fermions
Reducing the number of flavors in the microcanonical method, 10:11857 (J;US)
Flavor Model
Reducing the number of flavors in the microcanonical method, 10:11857 (J;US)
Jet Model
Comparison of quark and gluon jets, 10:11837 (R;DE)
Lattice Field Theory
Lattice Monte Carlo calculations of finite temperature QCD, 10:11851 (R;US)
Monte Carlo Method
Lattice Monte Carlo calculations of finite temperature QCD, 10:11851 (R;US)
Phase Transformations
Where is the continuum in lattice quantum chromodynamics?, 10:11858 (J;US)
Rest Mass
Monte Carlo calculation of hadron masses with light dynamical quarks, 10:11835 (R;DE)
Scale Dimension
Some comments on α/sub s/ and Λ/sub anti MS/, 10:11841 (R;US)

QUANTUM ELECTRODYNAMICS
Gauge Invariance
Gauge invariance and the finite-element solution of the Schwinger model, 10:11855 (J;US)

QUANTUM MECHANICS
Many-Body Problem
Finite-size scaling for quantum chains with an oscillatory energy gap, 10:11917 (R;DE)
Noise
Effect of noise on time-dependent quantum chaos, 10:11923 (J;US)
Supersymmetry
Quantum mechanics with extended supersymmetry and nonabelian gauge constraints, 10:11850 (R;DE)

QUARK MATERIAL
See QUARK MATTER

QUARK MATTER
Lattice Field Theory
Lattice Monte Carlo calculations of finite temperature QCD, 10:11851 (R;US)
Phase Transformations
Lattice Monte Carlo calculations of finite temperature QCD, 10:11851 (R;US)
Probes
Probes of the quark-gluon plasma as it might be produced in ultra-relativistic nuclear collisions, 10:11889 (R;US)
Production
Space station as quark matter factory, 10:11877 (R;US)
Viscosity
Dissipative phenomena in quark-gluon plasmas, 10:11848 (J;US)

QUARK MODEL
Mathematical Operators
Three-cocycle in mathematics and physics, 10:12019 (J;US)
Quantum Flavordynamics
Flavor mixing and the six quark model, 10:11854 (R;SE)

QUARK PLASMA
See QUARK MATTER

QUARK SEA
See QUARK MATTER

QUARK-GLUON PLASMA
See QUARK MATTER

QUARKONIUM
A hypothetical bound state of quark and antiquark.
Leptonic Decay
Some comments on α/sub s/ and Λ/sub anti MS/, 10:11841 (R;US)
Weak Hadronic Decay
Some comments on α/sub s/ and Λ/sub anti MS/, 10:11841 (R;US)

QUARKS
Bibliographies
Quarks, 10:11810 (R;US)

QUARTZ
Electric Conductivity
Behavior of electrical conduction of spinel and other insulating oxides in moderate electric fields at high temperature, 10:11396 (J;US)

QUARTZ MONZONITE
Geologic Structures
Geologic structure mapping database Spent Fuel Test - Climax, Nevada Test Site, 10:10992 (R;US)

QUINOLINES
Biological Effects
Excision repair of ultraviolet- and chemically-induced damage in the DNA of fibroblasts derived from two closely related species of marine fishes, 10:11701 (J;NL)
Hydrogenation
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 4, July-September 1984, 10:11459 (R;US)
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 3, April-June 1984, 10:11460 (R;US)

R

RACIAL GROUPS
See MINORITY GROUPS
RADAPPERTIZATION
See RADIOSTERILIZATION
RADIATION ACCIDENTS
Radiation Hazards
Consequence analysis of a hypothetical contained criticality accident in the Hanford Critical Mass Laboratory, 10:11168 (R;US)
RADIATION BELTS
Helium Ions
Charge-state composition of 0.4-MeV helium ions in earth's outer radiation belts during quiet times. Technical report, 10:11734 (R;US)
RADIATION DECONTAMINATION
See DECONTAMINATION
RADIATION DETECTORS
See also CHEMICAL RADIATION DETECTORS
CHERENKOV COUNTERS
SEMICONDUCTOR DETECTORS
SHOWER COUNTERS
Experimental studies of elementary particle interactions at high energies. Technical progress report, 10:11822 (R;US)
Report on the 1984 LBL workshop on detectors for relativistic nuclear collisions, 10:11550 (R;US)
RADIATION DOSIMETRY
See DOSIMETRY
RADICALS
Not to be used for compound descriptions.
See also ALKYL RADICALS
Spatial Distribution
Stochastic treatment of fast chemical reactions, 10:11472 (J;US)
RADIOACTIVE AEROSOLS
Mass Transfer
Aerosol instrumentation for the Marviken aerosol transport tests, 10:11131 (J;GB)
Radionuclide Migration
Accident-generated radioactive particle source term development for consequence assessment of nuclear fuel cycle facilities, 10:11612 (R;US)
RADIOACTIVE BIOLOGICAL WASTES
See RADIOACTIVE WASTES
RADIOACTIVE EFFLUENTS
Radiation Monitoring
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 5, Appendix E: environmental monitoring, 10:11195 (R;US)
RADIOACTIVE GASEOUS WASTES
See RADIOACTIVE WASTES
RADIOACTIVE PARTICULATES
See RADIOACTIVE AEROSOLS
RADIOACTIVE TRACERS
See RADIOPHARMACEUTICALS
RADIOACTIVE WASTE DISPOSAL
Containers
Test methods to predict long-term corrosion of container materials in repositories, 10:11345 (R;US)
Corrosion
Zircaloy cladding corrosion degradation in a Tuff repository: initial experimental plan, 10:10973 (R;US)
Radionuclide Migration
Radionuclide migration pathways analysis for the Oak Ridge Central Waste Disposal Facility on the West Chestnut Ridge site, 10:11002 (R;US)
Strontium sorption on Savannah River Plant soils, 10:10999 (R;US)
Research Programs
Commercial Nuclear Waste Research and Development Program. Annual report, fiscal year 1984, 10:10968 (R;US)
Simulation
Zircaloy cladding corrosion degradation in a Tuff repository: initial experimental plan, 10:10973 (R;US)
RADIOACTIVE WASTE FACILITIES
See also WIPP
Radiation Monitoring
Environmental monitoring report for the former Middlesex Sampling Plant and Middlesex Municipal Landfill Sites, calendar year 1983, 10:10971 (R;US)
Environmental monitoring report, 1980, 1981, 1982 for the former Middlesex Sampling Plant and Middlesex Municipal Landfill Sites, 10:10970 (R;US)
Remedial Action
Environmental monitoring report for the former Middlesex Sampling Plant and Middlesex Municipal Landfill Sites, calendar year 1983, 10:10971 (R;US)
Environmental monitoring report, 1980, 1981, 1982 for the former Middlesex Sampling Plant and Middlesex Municipal Landfill Sites, 10:10970 (R;US)
RADIOACTIVE WASTE MANAGEMENT
Materials
Purpose of the Materials Characterization Center, 10:10982 (R;US)
Reference and testing materials available from the Materials Characterization Center, 10:10980 (R;US)
Research Programs
Defense waste and byproducts management monthly report, November 1984, 10:10987 (R;US)
Defense waste and byproducts management monthly report, October 1984, 10:10988 (R;US)
RADIOACTIVE WASTE STORAGE
Research Programs
Defense waste and byproducts management monthly report, November 1984, 10:10987 (R;US)
Defense waste and byproducts management monthly report, October 1984, 10:10988 (R;US)
RADIOACTIVE WASTES
See also ALPHA-BEARING WASTES
HIGH-LEVEL RADIOACTIVE WASTES
LOW-LEVEL RADIOACTIVE WASTES
RADIOACTIVE EFFLUENTS
Decontamination
Studies of cation exchange for the isolation and concentration of trace level components of complex aqueous mixtures, 10:10974 (R;US)
RADIOBIOLOGICAL EFFECTS
See BIOLOGICAL RADIATION EFFECTS
RADIOCHEMICAL LABORATORIES
See HOT LABS
RADIOGRAPHS
See IMAGES
RADIOGRAPHY (BIOMEDICAL)
See BIOMEDICAL RADIOGRAPHY
RADIOIMMUNOASSAY
Accuracy
Value of α-fetoprotein determination in infants and a method of determination by RIA, 10:11650 (R;DE;In German)
RADIOISOTOPE-LABELLED DRUGS
See RADIOPHARMACEUTICALS
RADIOISOTOPES
Sampling
Assembly, operation and disassembly manual for the Battelle Large Volume Water Sampler (BLVWS), 10:11637 (R;US)
RADIOMETRIC GAGES
Materials Handling
Optimal linear filters for radiometric transport belt balances, 10:11561 (R;DE;In German)

RADIONUCLIDES
See RADIOISOTOPES
RADIOPHARMACEUTICALS
Chemical Preparation
Preparation of four fluorine-18-labeled estrogens and their selective uptakes in target tissues of immature rats, 10:11660 (J;US)
RADIOPROTECTIVE SUBSTANCES
Reviews
Chemical protection against ionizing radiation. Final report, 10:11676 (R;US)
RADIOSTERILIZATION
Demonstration Programs
Beneficial uses of nuclear byproducts/Sewage Sludge Irradiation Project. Progress report, January-June 1983, 10:11008 (R;US)
Byproducts Utilization Program: Sewage Sludge Irradiation Project. Progress report, July-December 1983, 10:11009 (R;US)
RADIOSURGERY
See RADIOTHERAPY
RADIOTHERAPY
Reviews
Neutrons and charged particles in radiotherapy. Oncology overview, 10:11659 (R;US)
RADIUM
Adsorption
Geochemical information for sites contaminated with low-level radioactive wastes: II. St. Louis Airport Storage Site, 10:11003 (R;US)
Solubility
Groundwater chemistry along flow paths between a proposed repository site and the accessible environment, 10:11000 (R;US)
Solvent Extraction
Investigations of ion-size-selective synergism in solvent extraction, 10:11433 (J;US)
Tissue Distribution
Distribution of radium and plutonium in human bone, 10:11672 (R;US)
RADON 220
Indoor Air Pollution
Source characterization and transport process affecting levels of radon and its decay products in an indoor environment. Final technical report, 10:11609 (R;US)
RADON 222
Indoor Air Pollution
Source characterization and transport process affecting levels of radon and its decay products in an indoor environment. Final technical report, 10:11609 (R;US)
RAIL TRANSPORT
Charges
Rail coal transportation under the Staggers Act, 10:11214 (R;US)
Laws
Rail coal transportation under the Staggers Act, 10:11214 (R;US)
RAILGUN ACCELERATORS
Performance Testing
H-Division materials physics quarterly report, April-June 1984, 10:11323 (R;US)
RAIN WATER
Water Chemistry
OSCAR experiment high-density network data report: Event 4 - April 21-23, 1981, 10:11593 (R;US)
RARE EARTHS
See also PRASEODYMIUM
Crystal Structure
H-Division materials physics quarterly report, April-June 1984, 10:11323 (R;US)
RAYLEIGH-TAYLOR INSTABILITY
Instability Growth Rates
Influence of gradual density transition and nonlinear saturation on Rayleigh-Taylor instability growth, 10:11934 (R;DE)
REACTOR ACCIDENTS
See also ATWS
LOSS OF COOLANT
LOSS OF FLOW
MELTDOWN
REACTOR CORE DISRUPTION
Computer Codes
RAMONA-3B, a code for BWR plant transients, 10:11138 (R;US)
Corium
Behavior of core debris ejected from a pressurized vessel into scaled reactor cavities, 10:11172 (R;US)
Fission Product Release
Behavior of Cs, I, and Te in the fission product release program at ORNL, 10:11157 (R;US)
Frequency distributions of activity concentrations after accidential releases of radionuclides, 10:11165 (R;DE;In German)
Fuel Element Failure
Damage and failure of previously irradiated fuel rods during a reactivity initiated accident, 10:11151 (R;US)
FRAP-T5 uncertainty study of five reactor transient and accident events, 10:11150 (R;US)
Heat Transfer
BEAGL-01: a computer code for calculating rapid LWR core transients. Volume 2. User's manual, 10:11160 (R;US)
RETRAN-02: a program for Transient Thermal-hydraulic Analysis of Complex Fluid Flow Systems. Volume 3. User's manual. Revision 2, 10:11174 (R;US)
RETRAN-02: a program for Transient Thermal-hydraulic Analysis of Complex Fluid Flow systems. Volume 2. Programmer's manual. Revision 2 (PWR; BWR), 10:11175 (R;US)
Human Factors Engineering
Regulatory analyses for severe accident issues: an example, 10:11170 (R;US)
Hydraulics
BEAGL-01: a computer code for calculating rapid LWR core transients. Volume 2. User's manual, 10:11160 (R;US)
RETRAN-02: a program for Transient Thermal-hydraulic Analysis of Complex Fluid Flow Systems. Volume 3. User's manual. Revision 2, 10:11174 (R;US)
RETRAN-02: a program for Transient Thermal-hydraulic Analysis of Complex Fluid Flow systems. Volume 2. Programmer's manual. Revision 2 (PWR; BWR), 10:11175 (R;US)
Iodine
Chemical behavior of fission product iodine following LWR accidents, 10:11143 (R;US)
Mathematical Models
Radiological consequence analysis with HEU and LEU fuels, 10:11159 (R;US)
Radiation Doses
Radiological consequence analysis with HEU and LEU fuels, 10:11159 (R;US)
Radiation Hazards
Analysis of uncertainties in CRAC2 calculations: wet deposition and plume rise, 10:11608 (R;US)
Reactor Kinetics
BEAGL-01: a computer code for calculating rapid LWR core transients. Volume 2. User's manual, 10:11160 (R;US)
Regulatory Guides
Regulatory analyses for severe accident issues: an example, 10:11170 (R;US)
Risk Assessment
Regulatory analyses for severe accident issues: an example, 10:11170 (R;US)
Simulation
Hydrogen studies during PBF Severe Fuel Damage tests, 10:11145 (R;US)
Thermal Shock
Experimental verification of the behavior of surface flaws in thick-walled steel cylinders during severe thermal shock, 10:11149 (R;US)
REACTOR COMPONENTS
See also BREEDING BLANKETS
FUEL ELEMENTS
REACTOR COOLING SYSTEMS

Off-Gas Systems
Parametric investigations on the retention of methyl iodide by a KI-impregnated activated carbon, 10:11124 (R;DE;In German)

REACTOR CONTROL THEORY
See REACTOR KINETICS

REACTOR COOLING SYSTEMS
See also PRIMARY COOLANT CIRCUITS
Pipes
Proceedings: second seminar on countermeasures for pipe cracking in BWRs. Volume 2. Remedy development, 10:11077 (R;US)

REACTOR CORE DISRUPTION
Radioactive Aerosols
UO_2 aerosol release from pools of sodium, 10:11156 (R;US)

REACTOR FUEL ELEMENTS
See FUEL ELEMENTS

REACTOR FUELS
See NUCLEAR FUELS

REACTOR INSTRUMENTATION
Level Indicators
High temperature, high pressure water level sensor, 10:11090 (R;US)

REACTOR KINETICS
Monte Carlo Method
MORSE Monte Carlo code, 10:11120 (R;US)

REACTOR LICENSING
Operating reactors licensing actions summary. Vol. 4, No. 10, 10:11116 (R;US)
Reviews
Operating reactors licensing actions summary. Volume 4, No. 11, 10:11117 (R;US)

REACTOR MATERIALS
To be assigned in conjunction with the specific descriptor for the material used in a reactor, provided this descriptor is not yet up-posted to reactor materials.
See also NUCLEAR FUELS
Chemical Reactions
Interaction of hot solid, core debris with concrete, 10:11171 (R;US)
Energy Absorption
An analysis of bremsstrahlung energy deposition in magnetic fusion first wall materials, 10:11994 (J;US)
Thermal Stresses
Interaction of hot solid, core debris with concrete, 10:11171 (R;US)

REACTOR SAFETY
Fuel-Cladding Interactions
Preliminary observation of large scale UO_2 melt-concrete interactions and sustained steel-concrete interaction with an overlying water pool, 10:11173 (R;US)
Research Programs
List of reports on reactor safety research of BMFT, CEA, EPRI, JSTA and USNRC, 10:11162 (R;DE;In German)
Reports of reactor safety research projects sponsored by the Federal Ministry for Research and Technology (BMFT), 10:11161 (R;DE;In German)

REACTOR SAFETY EXPERIMENTS
Heaters
Evaluation of on-line control techniques for heater rods in the Semiscale Mod-3 system, 10:11140 (R;US)
Testing and analysis of the Semiscale Mod-1 heater rod design, 10:11141 (R;US)

REACTOR STABILITY
Monitoring
BWR stability monitoring using neutron noise, 10:11091 (R;US)

REACTOR VESSELS
For nonpressurized containers of reactor cores and associated components.
Thermal Shock
Experimental verification of the behavior of surface flaws in thick-walled steel cylinders during severe thermal shock, 10:11149 (R;US)

REACTORS
See also HEAVY WATER COOLED REACTORS
HEAVY WATER MODERATED REACTORS
POWER REACTORS
PRODUCTION REACTORS
RESEARCH AND TEST REACTORS
THERMAL REACTORS
WATER COOLED REACTORS
Decontamination
Decontamination pays off for nuke owners, 10:11089 (J;US)

RECLAMATION
See LAND RECLAMATION

RECOVERY (TRITIUM)
See TRITIUM RECOVERY

RECYCLE (FUEL)
See FUEL CYCLE

REDUCTASES
See OXIDOREDUCTASES

REFRACTORIES
Compression Strength
Testing of refractories in co-containing coal gasification atmospheres. Final report, 10:10840 (R;US)
Materials Testing
Testing of refractories in co-containing coal gasification atmospheres. Final report, 10:10840 (R;US)
Thermal Conductivity
Hot wire thermal conductivity measurements in high temperature refractories, 10:11391 (R;US)
Wear Resistance
Testing of refractories in co-containing coal gasification atmospheres. Final report, 10:10840 (R;US)

REFUSE
See SOLID WASTES

REGENERATIVE FUEL CELLS
Performance
Status of solid polymer electrolyte fuel cell technology, 10:11260 (RA;US)
Uses
NASA fuel cell applications for space, 10:11256 (RA;US)

REGOLITH
See OVERBURDEN

REGULATORY GUIDES
Should be used to index all pieces of literature which are regulatory guides.
Decision Making
Regulatory analyses for severe accident issues: an example, 10:11170 (R;US)

RELEASE (FISSION PRODUCT)
See FISSION PRODUCT RELEASE

REMOTE HANDLING EQUIPMENT
Remote removal of contaminated equipment from a radiochemical engineering cell, 10:10985 (R;US)

RENEWABLE RESOURCES
Management
Technology, renewable resources, and American crafts: background paper, 10:11224 (R;US)

RESEARCH AND TEST REACTORS
Nuclear Fuels
US RERTR Program: overview, status and plans, 10:11134 (R;US)

RESEARCH PROGRAMS
To be used jointly with descriptor(s) for subject field and/or organization concerned.
Budgets
Funding of generic activities within DOE's Office of Assistant Secretary for Nuclear Energy, 10:11075 (R;US)
Planning
Process R and D plan: Post-Baseline Research and Technology Subcontract Programs (Task 203), 10:10838 (R;US)

RESIDENCES
See HOUSES

RESIDENTIAL BUILDINGS
See also APARTMENT BUILDINGS
HOUSES
MOBILE HOMES
Design
168 proof?, 10:11295 (J;US)
Energy Audits
Energy savings one and two years after participation in Minnesota home energy audit and retrofit loan programs, 10:11293 (R;US)

Energy Conservation
168 proof?, 10:11295 (J;US)
Retrofitting
Conservation's value varies with view, 10:11311 (J;US)
Weatherization
Three years after participation: electricity savings due to the BPA Residential Weatherization Pilot Program, 10:11292 (R;US)

RESIDENTIAL SECTOR
Energy Conservation
Introduction and background, 10:11282 (RA;US)

RESIDUAL FUEL OIL
See RESIDUAL FUELS

RESIDUAL FUELS
Sales
Petroleum Marketing Monthly, October 1984, 10:10941 (R;US)

RESIDUES
See also ASHES
SMOKES
Calorific Value
Gasification of residual materials from coal liquefaction. Final report, 10:10830 (R;US)
Chemical Composition
Gasification of residual materials from coal liquefaction. Final report, 10:10830 (R;US)
Gasification
Gasification of residual materials from coal liquefaction. Final report, 10:10830 (R;US)

RESIDUES (RADIOACTIVE)
See RADIOACTIVE WASTES

RESIDUUMS
See RESIDUAL FUELS

RESOURCE ASSESSMENT
Computer Calculations
Computer modelling of coal basins, 10:10891 (R;AU)
Statistical Models
Computer modelling of coal basins, 10:10891 (R;AU)

RESOURCES
See also CULTURAL RESOURCES
NATURE RESERVES
RENEWABLE RESOURCES
Information Dissemination
Corporate use of information regarding natural resources and environmental quality, 10:11186 (R;US)

REVEGETATION
Regulations
Shrub cover and density on western rangelands in relation to reclamation standards for surface mined lands in Wyoming, 10:10873 (RA;US)
Standards
Shrub cover and density on western rangelands in relation to reclamation standards for surface mined lands in Wyoming, 10:10873 (RA;US)

REVERSE-FIELD PINCH
Bulletin of the Electrotechnical Laboratory, Volume 48, No. 7, July 1984, 10:11942 (R;JP;In Japanese)

RHENIUM
Catalytic Effects
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 4, July-September 1984, 10:11459 (R;US)
Titration
Indirect determination of rhenium by EDTA titration, 10:11436 (TJ;US)

RHENIUM OXIDES
Crystal-Phase Transformations
Neutron scattering study of the pressure-induced phase transformation in ReO_3, 10:11395 (J;US)
Neutron Diffraction
Neutron scattering study of the pressure-induced phase transformation in ReO_3, 10:11395 (J;US)

RHODIUM
Catalytic Effects
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 4, July-September 1984, 10:11459 (R;US)
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 3, April-June 1984, 10:11460 (R;US)
Field Emission
Initial stages of oxide formation on rhodium field emitters, 10:11358 (J;US)
Oxidation
Initial stages of oxide formation on rhodium field emitters, 10:11358 (J;US)
Sorptive Properties
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 4, July-September 1984, 10:11459 (R;US)

RHODIUM OXIDES
Stoichiometry
Initial stages of oxide formation on rhodium field emitters, 10:11358 (J;US)

RICE
Enzyme Activity
Alcohol dehydrogenase and an inactivator from rice seedlings, 10:11644 (J;US)
Alcohol dehydrogenase inactivator from rice seedlings: properties and intracellular location, 10:11645 (J;US)

RINGS
Deformation
Ductile fracture of rapidly expanding rings, 10:11492 (J;US)
Ductility
Ductile fracture of rapidly expanding rings, 10:11492 (J;US)

RINGS (STORAGE)
See STORAGE RINGS

RISER CRACKING
See COAL LIQUEFACTION

RISK ASSESSMENT
Data Covariances
Overview of methods for uncertainty analysis and sensitivity analysis in probabilistic risk assessment, 10:11169 (R;US)
Sensitivity
Overview of methods for uncertainty analysis and sensitivity analysis in probabilistic risk assessment, 10:11169 (R;US)

RIVETS
See FASTENERS

ROADS
Bibliographies
New publications for road systems at coal mines, 10:10902 (RA;US)
Construction
New publications for road systems at coal mines, 10:10902 (RA;US)

ROADWAYS (MINES)
See MINE ROADWAYS

ROCK SALT
See SALT DEPOSITS

ROCKETS
Chemical Reactions
Mixing, chemical reaction and flow field development in ducted rockets, 10:11507 (R;US)
Fluid Flow
Mixing, chemical reaction and flow field development in ducted rockets, 10:11507 (R;US)
Mixing
Mixing, chemical reaction and flow field development in ducted rockets, 10:11507 (R;US)

ROCK-FLUID INTERACTIONS
Hydrothermal waste package interactions with methane-containing basalt groundwater, 10:10983 (R;US)

RODS (FUEL)
See FUEL RODS

ROOFS
Stability
Prediction and monitoring of roof conditions, 10:10901 (R;AU)

ROOM AND PILLAR MINING
Computerized Simulation
Longwall coal mining operations computer simulation, 10:10895 (R;AU)

RUBIDIUM
Solvent Extraction
Investigations of ion-size-selective synergism in solvent extraction, 10:11433 (J;US)
RUTHENIUM
Catalytic Effects
Catalysts possessing augmented C-O and C-N hydrogenolysis activity. Progress report No. 4, July-September 1984, 10:11459 (R;US)
RUTHENIUM COMPLEXES
Chemical Reactions
Synthesis and reactivity of heterodinuclear iron, ruthenium, and cobalt compounds containing bridging dithiomethylene ligands. Attempted synthesis of the iron carbyne compound $Cp(CO)FeCSCH_3$, 10:11461 (R;US)
Structural Chemical Analysis
Synthesis and reactivity of heterodinuclear iron, ruthenium, and cobalt compounds containing bridging dithiomethylene ligands. Attempted synthesis of the iron carbyne compound $Cp(CO)FeCSCH_3$, 10:11461 (R;US)
Synthesis
Synthesis and reactivity of heterodinuclear iron, ruthenium, and cobalt compounds containing bridging dithiomethylene ligands. Attempted synthesis of the iron carbyne compound $Cp(CO)FeCSCH_3$, 10:11461 (R;US)
RUTILE
Atom Transport
Diffusion of deuterium and hydrogen in rutile TiO_2 crystals at low temperatures, 10:11398 (J;US)

S

SAFETY (REACTOR)
See REACTOR SAFETY
SALINE ZONE
See OIL SHALES
SALMONELLA TYPHIMURIUM
Cell Killing
Role of the supX gene in sensitizing Salmonella typhimurium cells to respiration shutoff induced by far ultraviolet irradiation, 10:11684 (J;GB)
Respiration
Role of the supX gene in sensitizing Salmonella typhimurium cells to respiration shutoff induced by far ultraviolet irradiation, 10:11684 (J;GB)
SALT DEPOSITS
Geology
Gulf Coast Salt Domes geologic Area Characterization Report, Mississippi Study Area. Volume VII. Appendix (Cypress Creek, Lampton, and Richton domes), 10:10976 (R;US)
Gulf Coast Salt Domes geologic Area Characterization Report, North Louisiana Study Area. Volume IV. Technical report (Contains glossary; Vacherie and Rayburns domes), 10:10975 (R;US)
Hydrology
Gulf Coast Salt Domes geologic Area Characterization Report, Mississippi Study Area. Volume VII. Appendix (Cypress Creek, Lampton, and Richton domes), 10:10976 (R;US)
Gulf Coast Salt Domes geologic Area Characterization Report, North Louisiana Study Area. Volume IV. Technical report (Contains glossary; Vacherie and Rayburns domes), 10:10975 (R;US)
Radioactivity
Tritium analysis of the Tatum Salt Dome Area, 10:11635 (R;US)
Temperature Effects
Measured data from the Avery Island Site C heater test, 10:10967 (R;US)
Temperature Measurement
Measured data from the Avery Island Site C heater test, 10:10967 (R;US)
SALTS
Use specific salts whenever possible
See also MOLTEN SALTS
Corrosive Effects
Test methods to predict long-term corrosion of container materials in repositories, 10:11345 (R;US)
SAMPLERS
See also AIR SAMPLERS
Design
Assembly, operation and disassembly manual for the Battelle Large Volume Water Sampler (BLVWS), 10:11637 (R;US)
SANDSTONES
Permeability
Permeability changes during time-dependent deformation of silicate rock, 10:10996 (J;US)
Wave Propagation
Explosive-induced wave propagation in nugget sandstone, 10:11728 (J;US)
SANITARY LANDFILLS
Environmental Impacts
Influence of landfills on ground-water quality, 10:11632 (R;US)
SATELLITES
Regenerative Fuel Cells
NASA fuel cell applications for space, 10:11256 (RA;US)
SAVANNAH RIVER PLANT
Radiation Monitoring
Aerial radiological monitoring survey, Savannah River Plant, 10:11620 (R;US)
Remote Sensing
Multispectral Remote Sensing at the Savannah River Plant, 10:11623 (R;US)
SCANDIUM ALLOYS
Electric Conductivity
Phase stability and magnetic properties of UAl_2 based pseudobinary spin fluctuation compounds, 10:11341 (R;US)
Magnetic Susceptibility
Phase stability and magnetic properties of UAl_2 based pseudobinary spin fluctuation compounds, 10:11341 (R;US)
Phase Stability
Phase stability and magnetic properties of UAl_2 based pseudobinary spin fluctuation compounds, 10:11341 (R;US)
Specific Heat
Phase stability and magnetic properties of UAl_2 based pseudobinary spin fluctuation compounds, 10:11341 (R;US)
SCHNELLER NATRIUMGEKUEHLTER REAKTOR
See SNR-1 REACTOR
SCHOOL FACILITIES
See EDUCATIONAL FACILITIES
SCHOOL PLANT
See EDUCATIONAL FACILITIES
SCHOOLS
See EDUCATIONAL FACILITIES
SCRAP
Melting
Sliding-Bed (trademark) aluminum-scrap preheater. Final report, October 1982-May 1984, 10:11310 (R;US)
SCREWS
See FASTENERS
SECONDARY BATTERIES
See ELECTRIC BATTERIES
SECONDARY RECOVERY
See ENHANCED RECOVERY
SEDIMENTARY BASINS
Geology
Facies modelling and palaeoenvironmental reconstruction of coal measures sedimentation within several Queensland coal basins, 10:10892 (R;AU)
SEDIMENTS
Distribution
Shelfbreak circulation, fronts and physical oceanography: east and west coast perspectives, 10:11730 (J;US)
SEISMIC P WAVES
Wave Propagation
Horizontal propagation of P waves through scattering media: analog model studies relevant to long-range P/sub n/ propagation, 10:11722 (J;US)
SELENIUM
Energy-Level Transitions
Demonstration of a soft x-ray amplifier, 10:11499 (J;US)

Exploding foil technique for achieving a soft x-ray laser, 10:11498 (J;US)
Explosions
Exploding foil technique for achieving a soft x-ray laser, 10:11498 (J;US)
Population Inversion
Demonstration of a soft x-ray amplifier, 10:11499 (J;US)
Exploding foil technique for achieving a soft x-ray laser, 10:11498 (J;US)

SEMICONDUCTOR COUNTERS
See SEMICONDUCTOR DETECTORS

SEMICONDUCTOR DETECTORS
See also GE SEMICONDUCTOR DETECTORS
Trigger Circuits
Fast timing methods for semiconductor detectors. Revision, 10:11563 (R;US)

SEMICONDUCTOR MATERIALS
If possible index also the specific compounds.
Faraday Effect
Optimum method of analysis of Faraday rotation and ellipticity measurements in a metal-oxide-semiconductor system, 10:11910 (J;GB)
Ion Implantation
Tailored surface modification by ion implantation and laser treatment, 10:11362 (J;US)
Microstructure
High resolution Z-contrast imaging and lattice location analysis of dopants in ion-implanted silicon, 10:11407 (R;US)
Surface Treatments
Tailored surface modification by ion implantation and laser treatment, 10:11362 (J;US)

SENEGAL
Industrial Plants
Industrial energy conservation in Morocco and Senegal, 10:11305 (RA;US)
Transportation Sector
Potential for energy conservation in Dakar transportation system, 10:11301 (RA;US)

SEQUESTRENE
See EDTA

SEWAGE SLUDGE
Anaerobic Digestion
Biogasification products of water hyacinth wastewater reclamation, 10:11012 (R;US)
Drying
Beneficial uses of nuclear byproducts/Sewage Sludge Irradiation Project. Progress report, January-June 1983, 10:11008 (R;US)
Byproducts Utilization Program: Sewage Sludge Irradiation Project. Progress report, July-December 1983, 10:11009 (R;US)
Radiosterilization
Beneficial uses of nuclear byproducts/Sewage Sludge Irradiation Project. Progress report, January-June 1983, 10:11008 (R;US)
Byproducts Utilization Program: Sewage Sludge Irradiation Project. Progress report, July-December 1983, 10:11009 (R;US)
Regulations
Byproducts Utilization Program: Sewage Sludge Irradiation Project. Progress report, July-December 1983, 10:11009 (R;US)

SHAFTS
Fasteners
Locking mechanism for indexing device, 10:11489 (P;US)
Positioning
Locking mechanism for indexing device, 10:11489 (P;US)

SHATTERING
See FRAGMENTATION

SHEATHS (FUEL)
See FUEL CANS

SHIELDING
See also MAGNETIC SHIELDING
Information Centers
Value of the National Energy Software Center and the Radiation Shielding Information Center. Volume 2, 10:12028 (RA;US)

SHIFT PROCESSES
Research Programs
Development of an advanced water-gas shift conversion system. Monthly project status report No. 8, December 1-December 31, 1984, 10:10843 (R;US)

SHIPMENT
See TRANSPORT

SHOREHAM REACTOR
Shoreham, New York, USA
Reactor Safety
Safety Evaluation Report related to the operation of Shoreham Nuclear Power Station, Unit No. 1 (Docket No. 50-322). Supplement No. 8, 10:11166 (R;US)

SHOWER COUNTERS
Detects high energy gamma radiation or high energy particles on basis of cascade showers in layered absorbers.
D0 Project at Fermilab, 10:11543 (R;US)

SHRUBS
Productivity
Standing crop and production in an undisturbed shrubsteppe community in eastern Washington, 10:11028 (R;US)
Roots
Rooting depth and distributions of deep-rooted plants in the 200 Area control zone of the Hanford Site, 10:11665 (R;US)

SIALON
See ALUMINIUM OXIDES

SILANES
Density
Density of gap states in hydrogenated amorphous silicon, 10:11409 (R;US)
Fabrication
Density of gap states in hydrogenated amorphous silicon, 10:11409 (R;US)
Infrared Spectra
Density of gap states in hydrogenated amorphous silicon, 10:11409 (R;US)
Optical Properties
Density of gap states in hydrogenated amorphous silicon, 10:11409 (R;US)
Photoconductivity
Density of gap states in hydrogenated amorphous silicon, 10:11409 (R;US)
Investigation of gap states in a-Si:H using dual beam photoconductivity and photoluminescence, 10:11387 (R;US)
Photoluminescence
Investigation of gap states in a-Si:H using dual beam photoconductivity and photoluminescence, 10:11387 (R;US)

SILICA
Binding Energy
Properties of lanthanide oxides as supports for transition metal catalysts. Progress report, May 1, 1984-April 30, 1985, 10:11441 (R;US)
Catalytic Effects
Characterization of supported metal catalysts by imaging, microdiffraction and microanalysis techniques, 10:11439 (R;US)
Dissolution
Coupled diffusion phenomena. Final report, 10:11392 (R;US)
Thermodynamic Properties
Coupled diffusion phenomena. Final report, 10:11392 (R;US)

SILICATES
See also CALCIUM SILICATES
MAGNESIUM SILICATES
SODIUM SILICATES
Physical Radiation Effects
Self-radiation damage in actinide host phases of nuclear waste forms ($Ca_2Nd_8(SiO_4)_6O_2$; $Gd_2Ti_2O_7$; $CaZrTi_2O_7$), 10:10981 (R;US)

SILICEOUS ROCK
See SANDSTONES

SILICON
Annealing
Thermodynamic and kinetic studies of pulsed laser annealing from transient conductivity measurements, 10:11349 (R;US)
Crystal Growth
Overheating and undercooling in silicon during pulsed laser irradiation, 10:11405 (R;US)

Crystal Structure
Local atomic structure of a clean surface by surface-extended x-ray absorption fine structure: Amorphized Si, 10:11417 (J;US)
Crystallization
Thermodynamic and kinetic studies of pulsed laser annealing from transient conductivity measurements, 10:11349 (R;US)
Diffusion
Low-temperature ion beam mixing of Pt and Si markers in Ge, 10:11416 (J;US)
Electric Conductivity
High sheet resistance, arsenic implanted polycrystalline silicon for integrated circuit resistors, 10:11519 (R;US)
Electrical Properties
Compensation of dangling bonds in A-Si, Ge:H alloys. Annual report, 10:11036 (R;US)
Grain Boundaries
Determination of the grain boundary recombination velocity in polycrystalline silicon as a function of illumination from photoconductance measurements, 10:11041 (J;GB)
Effective monatomic hydrogen diffusion constants in polycrystalline silicon, 10:11032 (RA;US)
Hydridation
Density of gap states in hydrogenated amorphous silicon, 10:11409 (R;US)
Ion Implantation
High sheet resistance, arsenic implanted polycrystalline silicon for integrated circuit resistors, 10:11519 (R;US)
Time-resolved studies of rapid solidification in highly undercooled molten silicon, 10:11406 (R;US)
Melting
Evidence for as doping effects on resolidification dynamics during pulsed laser melting, 10:11412 (R;US)
Overheating and undercooling in silicon during pulsed laser irradiation, 10:11405 (R;US)
Melting Points
Thermodynamic and kinetic studies of pulsed laser annealing from transient conductivity measurements, 10:11349 (R;US)
Microstructure
High resolution Z-contrast imaging and lattice location analysis of dopants in ion-implanted silicon, 10:11407 (R;US)
Oscillator Strengths
H-Division materials physics quarterly report, April-June 1984, 10:11323 (R;US)
Physical Radiation Effects
Time-resolved studies of rapid solidification in highly undercooled molten silicon, 10:11406 (R;US)
Recombination
Determination of the grain boundary recombination velocity in polycrystalline silicon as a function of illumination from photoconductance measurements, 10:11041 (J;GB)
Reflectivity
Time-resolved studies of rapid solidification in highly undercooled molten silicon, 10:11406 (R;US)
Solidification
Evidence for as doping effects on resolidification dynamics during pulsed laser melting, 10:11412 (R;US)
Sputtering
Compensation of dangling bonds in A-Si, Ge:H alloys. Annual report, 10:11036 (R;US)
Superheating
Thermodynamic and kinetic studies of pulsed laser annealing from transient conductivity measurements, 10:11349 (R;US)
X-Ray Spectra
Local atomic structure of a clean surface by surface-extended x-ray absorption fine structure: Amorphized Si, 10:11417 (J;US)

SILICON 28 REACTIONS
Spallation
Nuclear physics experiments with the ORNL-HHIRF supersonic gas jet target, 10:11868 (R;US)

SILICON ALLOYS
Electrical Properties
Compensation of dangling bonds in A-Si, Ge:H alloys. Annual report, 10:11036 (R;US)
Structural and electronic properties of amorphous-silicon-based alloy materials. Final report, June 1983-May 1984, 10:11037 (R;US)
Microstructure
Structural and electronic properties of amorphous-silicon-based alloy materials. Final report, June 1983-May 1984, 10:11037 (R;US)
Sputtering
Compensation of dangling bonds in A-Si, Ge:H alloys. Annual report, 10:11036 (R;US)

SILICON CARBIDES
Flexural Strength
Particulate toughened silicon carbide, 10:11404 (R;US)
Fracture Properties
Particulate toughened silicon carbide, 10:11404 (R;US)
Hot Pressing
Particulate toughened silicon carbide, 10:11404 (R;US)

SILICON FLUORIDES
Infrared Spectra
Orientational ordering and site structure of SiF_4 trapped in rare gas solids, 10:11787 (J;US)

SILICON HYDRIDES
See SILANES

SILICON OXIDES
See also CRISTOBALITE
QUARTZ
SILICA
Binding Energy
Characterization of high temperature vapors of import to combustion and gasification processes in the energy technologies. Final report, March 1, 1980-March 1, 1981, 10:10835 (R;US)
Excited States
Characterization of high temperature vapors of import to combustion and gasification processes in the energy technologies. Final report, March 1, 1980-March 1, 1981, 10:10835 (R;US)
Phase Studies
Stable and metastable phase equilibria and reactions in the SiO_2-αAl_2O_3 system, 10:11400 (J;IT)
Synthesis
Characterization of high temperature vapors of import to combustion and gasification processes in the energy technologies. Final report, March 1, 1980-March 1, 1981, 10:10835 (R;US)

SILICON SOLAR CELLS
Computer-Aided Design
Thin-film polycrystalline silicon research. Final report, August 1983-August 1984, 10:11038 (R;US)
Efficiency
Development of the Sandia 200X experimental silicon module, 10:11030 (RA;US)
Solar spectrum influence on the annual performance of AlGaAs/Si stacked cells, 10:11033 (RA;US)
Electrical Testing
Thin-film polycrystalline silicon research. Final report, August 1983-August 1984, 10:11038 (R;US)
Fabrication
Thin-film polycrystalline silicon research. Final report, August 1983-August 1984, 10:11038 (R;US)
Grain Boundaries
Effective monatomic hydrogen diffusion constants in polycrystalline silicon, 10:11032 (RA;US)
Materials
Effective monatomic hydrogen diffusion constants in polycrystalline silicon, 10:11032 (RA;US)
Optics
Development of the Sandia 200X experimental silicon module, 10:11030 (RA;US)
Performance
Solar spectrum influence on the annual performance of AlGaAs/Si stacked cells, 10:11033 (RA;US)
Performance Testing
Development of the Sandia 200X experimental silicon module, 10:11030 (RA;US)
Radiation Effects
Radiation Damage Workshop, 10:11026 (R;US)

Recrystallization
Zone-melting recrystallization for solar cells. Final report, September 1, 1982-August 31, 1984, 10:11025 (R;US)
Zone Melting
Zone-melting recrystallization for solar cells. Final report, September 1, 1982-August 31, 1984, 10:11025 (R;US)

SILICON SULFIDES
Binding Energy
Characterization of high temperature vapors of import to combustion and gasification processes in the energy technologies. Final report, March 1, 1980-March 1, 1981, 10:10835 (R;US)
Excited States
Characterization of high temperature vapors of import to combustion and gasification processes in the energy technologies. Final report, March 1, 1980-March 1, 1981, 10:10835 (R;US)
Synthesis
Characterization of high temperature vapors of import to combustion and gasification processes in the energy technologies. Final report, March 1, 1980-March 1, 1981, 10:10835 (R;US)

SILVER
Superconductivity
Electron localization and superconductivity of very thin epitaxially grown Ag films on Ge(001). Technical report, 10:11324 (R;US)
Wettability
Wetting of nickel by silver, 10:11381 (J;GB)

SISTER CHROMATID EXCHANGES
Molecular Biology
Relationship between sister-chromatid exchange and perturbations in DNA replication in mutant EM9 and normal CHO cells, 10:11646 (J;NL)

SKELETON
See also BONE JOINTS
Sample Preparation
Rapid and simple procedure for visualization of amphibian skeletons for teratological studies, 10:11666 (J;US)

SKYLIGHTS
Attitudes
Windows, skylights, and atria: occupants' visual/subjective comparison, 10:11316 (R;US)

SLC
See STANFORD LINEAR COLLIDER

SLOT OVENS
See COKE OVENS

SLUGS (FUEL)
See FUEL RODS

SLURRIES (FUEL)
See FUEL SLURRIES

SMELTERS
Fuel Feeding Systems
Coal firing of the Sirosmelt reactors, 10:10926 (R;AU)

SMOKES
Environmental Impacts
Effects of interactive transport and scavenging of smoke on the calculated temperature change resulting from large amounts of smoke, 10:11597 (R;US)

SNAP 8 REACTOR
Fuel Cans
Electron microprobe analysis of irradiated S8ER cladding, 10:11114 (R;US)
Materials Testing
Tensile and stress rupture tests of S8DR Hastelloy-N heats: ORNL verification tests, 10:11344 (R;US)

SNR REACTOR
See SNR-1 REACTOR

SNR-1 REACTOR
Prior to 1977, SNR REACTOR was used.
Loss of Flow
Two-dimensional modeling of sodium boiling in a simulated LMFBR loss-of-flow test, 10:11155 (R;US)

SNR-300 REACTOR
See SNR-1 REACTOR

SODIUM
Oscillator Strengths
H-Division materials physics quarterly report, April-June 1984, 10:11323 (R;US)
Photoionization
Low energy ion-neutral collisions. Progress report, June 1, 1984-May 31, 1985, 10:11766 (R;US)
Solvent Extraction
Investigations of ion-size-selective synergism in solvent extraction, 10:11433 (J;US)
Wettability
Wetting characteristics of sodium on β''-alumina and on nasicon, 10:11180 (J;GB)

SODIUM CHLORIDES
Corrosive Effects
Initiation of single corrosion sites on iron by focused laser illumination, 10:11372 (J;GB)
Electronic Structure
Ab initio effective core potentials for molecular calculations. Potentials for main group elements Na to Bi, 10:11779 (J;US)

SODIUM CITRATES
See SODIUM COMPOUNDS

SODIUM COMPOUNDS
See also SODIUM CHLORIDES
SODIUM FLUORIDES
SODIUM HYDROXIDES
SODIUM OXIDES
SODIUM SILICATES
SODIUM SULFATES
Gas Chromatography
Identification of lignosulfonic acid and humic acid by pyrolysis, gas chromatography and mass spectrometry (Py-GC-MS) (Salts of lignosulfonic acid), 10:11437 (TG;US)
Mass Spectroscopy
Identification of lignosulfonic acid and humic acid by pyrolysis, gas chromatography and mass spectrometry (Py-GC-MS) (Salts of lignosulfonic acid), 10:11437 (TG;US)
Pyrolysis
Identification of lignosulfonic acid and humic acid by pyrolysis, gas chromatography and mass spectrometry (Py-GC-MS) (Salts of lignosulfonic acid), 10:11437 (TG;US)
Wetting Agents
Wetting characteristics of sodium on β''-alumina and on nasicon, 10:11180 (J;GB)

SODIUM FLUORIDES
Electronic Structure
Ab initio effective core potentials for molecular calculations. Potentials for main group elements Na to Bi, 10:11779 (J;US)

SODIUM HYDROXIDES
Binding Energy
Characterization of high temperature vapors of import to combustion and gasification processes in the energy technologies. Final report, March 1, 1980-March 1, 1981, 10:10835 (R;US)
Excited States
Characterization of high temperature vapors of import to combustion and gasification processes in the energy technologies. Final report, March 1, 1980-March 1, 1981, 10:10835 (R;US)
Regeneration
Bench scale development of the TRW process for cleaning coal (gravimelt process). Quarterly technical progress report, August-October 1984, 10:10842 (R;US)
Synthesis
Characterization of high temperature vapors of import to combustion and gasification processes in the energy technologies. Final report, March 1, 1980-March 1, 1981, 10:10835 (R;US)

SODIUM LAURYL SULFATES
See SODIUM COMPOUNDS

SODIUM MINERALS
See MINERALS

SODIUM OXIDES
Binding Energy
Characterization of high temperature vapors of import to combustion and gasification processes in the energy

technologies. Final report, March 1, 1980-March 1, 1981, 10:10835 (R;US)

Excited States

Characterization of high temperature vapors of import to combustion and gasification processes in the energy technologies. Final report, March 1, 1980-March 1, 1981, 10:10835 (R;US)

Synthesis

Characterization of high temperature vapors of import to combustion and gasification processes in the energy technologies. Final report, March 1, 1980-March 1, 1981, 10:10835 (R;US)

SODIUM SILICATES

Physical Properties

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SODIUM SULFATES

Regeneration

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Evaluation of the NOXSO combined NO/sub x//SO_2 flue gas treatment process: process chemistry, reaction kinetics and sorbent performance. Monthly progress report, March 1, 1983-March 31, 1983, 10:10864 (R;US)

Sorptive Properties

Evaluation of the NOXSO combined NO/sub x//SO_2 flue gas treatment process: process chemistry, reaction kinetics and sorbent performance. Monthly progress report, March 1, 1983-March 31, 1983, 10:10864 (R;US)

SODIUM-SULFUR BATTERIES

Solid Electrolytes

Some aspects of breakdown of β''-alumina solid electrolyte, 10:11181 (J;GB)

Wetting characteristics of sodium on β''-alumina and on nasicon, 10:11180 (J;GB)

SOILS

Chemical Analysis

Geochemical information for sites contaminated with low-level radioactive wastes: II. St. Louis Airport Storage Site, 10:11003 (R;US)

Chemical Properties

Characterization of soils at proposed Solid Waste Storage Area (SWSA) 7, 10:11625 (R;US)

Geochemistry

Site characterization of the West Chestnut Ridge site, 10:10977 (R;US)

Hydraulic Conductivity

Characterization of soils at proposed Solid Waste Storage Area (SWSA) 7, 10:11625 (R;US)

Mineralogy

Characterization of soils at proposed Solid Waste Storage Area (SWSA) 7, 10:11625 (R;US)

Site characterization of the West Chestnut Ridge site, 10:10977 (R;US)

Radioactivity

Tritium analysis of the Tatum Salt Dome Area, 10:11635 (R;US)

Radionuclide Migration

Characterization and assessment for the Weldon Spring Quarry low-level radioactive waste storage site, 10:10969 (R;US)

Field studies on the terrestrial behavior of actinide elements in East Tennessee, 10:11619 (R;US)

Relationship between burial depth and radiocesium and radiostrontium and their accumulation in crop plants, 10:11621 (R;US)

Sorptive Properties

Characterization of soils at proposed Solid Waste Storage Area (SWSA) 7, 10:11625 (R;US)

Geochemical information for sites contaminated with low-level radioactive wastes: II. St. Louis Airport Storage Site, 10:11003 (R;US)

Strontium sorption on Savannah River Plant soils, 10:10999 (R;US)

Stabilization

Innovative electrical technique for in-place stabilization of contaminated soils, 10:10979 (R;US)

SOLAR ABSORBERS

Corrosion Resistance

Corrosion resistance of metallic solar absorber materials in a range of heat transfer fluids. Final technical report, 10:11055 (R;US)

SOLAR ACTIVITY

See also SOLAR RADIO BURSTS
SOLAR X-RAY BURSTS

Variations

Solar-geophysical data Number 477, May 1984. Part 2 (comprehensive reports). Data for November 1983, July 1981, and miscellanea, 10:11744 (R;US)

SOLAR CELLS

See also GALLIUM ARSENIDE SOLAR CELLS
SILICON SOLAR CELLS

Meetings

Photovoltaic advanced research and development 6th annual review meeting. Abstracts, 10:11035 (R;US)

SOLAR COLLECTORS

See also CONCENTRATING COLLECTORS
FLAT PLATE COLLECTORS
SOLAR PONDS

Glazing Materials

Protection of Lexan from uv radiation by photodownconversion. Final report, 10:11056 (R;US)

Protective Coatings

Protection of Lexan from uv radiation by photodownconversion. Final report, 10:11056 (R;US)

SOLAR CONCENTRATORS

Optics

Fundamentals and techniques of nonimaging optics. Final report, 10:11057 (R;US)

SOLAR COOLING SYSTEMS

Absorption Refrigeration Cycle

Development of a single-family absorption chiller for use in a solar heating and cooling system. Phase III, final report. Volume I, 10:11051 (R;US)

Development of a single-family absorption chiller for use in a solar heating and cooling system. Phase III, final report. Volume II, 10:11052 (R;US)

Computer-Aided Design

Development of a single-family absorption chiller for use in a solar heating and cooling system. Phase III, final report. Volume I, 10:11051 (R;US)

Development of a single-family absorption chiller for use in a solar heating and cooling system. Phase III, final report. Volume II, 10:11052 (R;US)

Field Tests

Engineering field test of a solar cooling system, data item No. 12. Final report, Phases I, II and III, 10:11053 (R;US)

Performance Testing

Development of a single-family absorption chiller for use in a solar heating and cooling system. Phase III, final report. Volume I, 10:11051 (R;US)

Development of a single-family absorption chiller for use in a solar heating and cooling system. Phase III, final report. Volume II, 10:11052 (R;US)

SOLAR DRYERS

Byproducts Utilization Program: Sewage Sludge Irradiation Project. Progress report, July-December 1983, 10:11009 (R;US)

SOLAR NEUTRINOS

Prior to July, 1975 information was indexed to NEUTRINOS.

Measuring Methods

Molybdenum solar neutrino experiment, 10:11740 (R;US)

Neutrino Detection

Chlorine solar neutrino experiment, 10:11735 (R;US)

Origin

Proposed solar neutrino experiment using $^{81}Br(nu,e^-)^{81}Kr$, 10:11736 (R;US)

SOLAR ONE POWER PLANT

See BARSTOW SOLAR PILOT PLANT

SOLAR PONDS

Bibliographies

Solar ponds: a selected bibliography, 10:11060 (R;US)

SOLAR RADIO BURSTS
Fundamental and harmonic emission in interplanetary type 2 radio bursts, 10:11743 (R;US)
SOLAR SEA POWER PLANTS
See OCEAN THERMAL POWER PLANTS
SOLAR STILLS
Feasibility Studies
Solar-powered alcohol still. Final technical report, 10:11020 (R;US)
SOLAR X-RAY BURSTS
Meetings
High energy transients in astrophysics , 10:11746 (B;US)
SOLID ELECTROLYTES
Decomposition
Some aspects of breakdown of β''-alumina solid electrolyte, 10:11181 (J;GB)
SOLID SOLUTIONS
Phase Diagrams
Prediction of solid + liquid equilibrium diagrams for binary mixtures forming solid solutions with an extremum, 10:11379 (J;US)
SOLID STATE LASERS
See also NEODYMIUM LASERS
Frequency Converters
Nonlinear wavelength conversion techniques for laser light harmonic generation by new nonlinear optical crystals, 10:11504 (TJ;US)
SOLID WASTES
See also SCRAP
TAILINGS
Leaching
Mobility of toxic compounds from hazardous wastes. Report for January 1982-December 1983, 10:11190 (R;US)
Waste Processing
Effectiveness of regional committees in implementing regional resource recovery programs, 10:11314 (R;US)
SOLIDS
Crystal Structure
Interpretation of diffuse low-energy electron diffraction intensities, 10:11909 (J;US)
Lattice Vibrations
Effect of a magnetic field on the vibrations of an ionic lattice, 10:11908 (J;US)
SOLVATED ELECTRONS
G Value
Stochastic treatment of fast chemical reactions, 10:11472 (J;US)
SOLVENT EXTRACTION
Organic Solvents
Bifunctional organophosphorus liquid-liquid extraction reagents: development and applications, 10:11464 (R;US)
SOLVENT-REFINED COAL PROCESS
See SRC PROCESS
SOLVENT-REFINING COAL PLANTS
See COAL PREPARATION PLANTS
SRC PROCESS
SOOT
Chemical Reaction Yield
Combustion characteristics of synthetic liquid fuels. Quarterly technical progress report,January 1-March 31, 1982, 10:11013 (R;US)
Identification and temporal behavior of radical intermediates formed during the combustion and pyrolysis of gaseous fuels: kinetic pathways to soot formation. Progress report, September 1, 1982-June 30, 1985, 10:11475 (R;US)
SOUTH ATLANTIC BIGHT
Oceanography
Nearshore transport processes affecting the dilution and fate of energy-related contaminants. Progress report, June 1, 1981-November 30, 1984, 10:11729 (R;US)
SOYBEANS
Enzyme Inhibitors
Crystallization of two cubic forms of soybean trypsin inhibitor E-I, a member of the Bowman-Birk inhibitor family, 10:11643 (J;US)
SPACE LATTICES
See CRYSTAL LATTICES
SPACE VEHICLES
Biological Shielding
Human exposure in low Earth orbit, 10:11904 (R;US)
Regenerative Fuel Cells
NASA fuel cell applications for space, 10:11256 (RA;US)
SPACECRAFT POWER SUPPLIES
Fuel Cells
NASA fuel cell applications for space, 10:11256 (RA;US)
Uses
NASA fuel cell applications for space, 10:11256 (RA;US)
SPARK IGNITION ENGINES
Corrosion
Engine wear with methanol fuel in a nitrogen-free environment. Interim report May-December 1983, 10:11320 (R;US)
Exhaust Gases
Utilization research, Volume III. Monthly progress report for November 1984, 10:11321 (R;US)
Fuel Substitution
Utilization research, Volume III. Monthly progress report for November 1984, 10:11321 (R;US)
Wear
Engine wear with methanol fuel in a nitrogen-free environment. Interim report May-December 1983, 10:11320 (R;US)
SPECTROMETERS
See also MAGNETIC SPECTROMETERS
MASS SPECTROMETERS
NEUTRON SPECTROMETERS
Design
Micro-column plasma emission liquid chromatograph, 10:11580 (P;US)
SPEED REGULATORS
Performance Testing
Darrieus rotor with forward tilting blade speed control, 10:11064 (J;US)
SPENT FUEL CASKS
Comparative Evaluations
Breeder Spent Fuel Handling (BSFH) cask study for FY83. Final report, 10:10966 (R;US)
Heat Transfer
Breeder Spent Fuel Handling (BSFH) cask study for FY83. Final report, 10:10966 (R;US)
Testing
Commercial Nuclear Waste Research and Development Program. Annual report, fiscal year 1984, 10:10968 (R;US)
SPENT FUEL ELEMENTS
Corrosion Resistance
Zircaloy cladding corrosion degradation in a Tuff repository: initial experimental plan, 10:10973 (R;US)
Sorting
Segregation of spent N-Reactor fuel by plutonium isotopic content, 10:10965 (R;US)
SPENT FUEL STORAGE
See also DRY STORAGE
Corrosion
Zircaloy cladding corrosion degradation in a Tuff repository: initial experimental plan, 10:10973 (R;US)
Dry Storage
Storage characteristics of spent HTR fuel elements in transport and storage containers of modular cast iron, 10:11108 (R;DE;In German)
Research Programs
Commercial Nuclear Waste Research and Development Program. Annual report, fiscal year 1984, 10:10968 (R;US)
SPERMATOGONIA
Radiosensitivity
Effect of ethyl-, methyl- and hydroxyethyl-nitrosourea on the mouse testis, 10:11705 (J;NL)
SPINELS
Carbon
Carbon abundances in mantle minerals determined by nuclear reaction analysis, 10:11721 (J;US)
Electric Conductivity
Behavior of electrical conduction of spinel and other insulating oxides in moderate electric fields at high temperature, 10:11396 (J;US)

Physical Radiation Effects
Effects of alpha irradiation on barium hollandite and nickel-iron spinel, 10:11410 (R;US)
Raman Spectra
Isotope studies of Fe-18Cr-3Mo (100) oxidation using Raman spectroscopy, 10:11351 (R;US)

SPOIL BANKS
Ground Water
Chemical quality of the saturated zone associated with contour surface mining spoil and its effect on stream water quality, 10:10883 (RA;US)
Hydrology
Hydrologic characterization of the saturated zone associated with contour surface mining spoil in the New River Basin of Tennessee, 10:10881 (RA;US)
Leaching
Modeling water quality during salty spoil suspension events, 10:10872 (RA;US)
Mechanical Properties
Evaluation of slope stability and foundation suitability for four southwestern Virginia mine spoils, 10:10875 (RA;US)
Revegetation
Vegetative response to topsoil versus alternative growth materials in a four-year old study in Kentucky, 10:10874 (RA;US)
Slope Stability
Evaluation of slope stability and foundation suitability for four southwestern Virginia mine spoils, 10:10875 (RA;US)
Stability of spoil piles and highwalls in deep surface mines, 10:10900 (R;AU)

SPUTTERING
Chemical Reactions
Use of markers to elucidate reacting sputtering processes, 10:11768 (R;US)

SRC PROCESS
Chemical Reactors
Existing technology transfer report dissolver cold-flow modelling, 10:10836 (R;US)
Demonstration Plants
6000 tpd SRC-I Demonstration Plant: Plant Availability Study and Utilization Model non-proprietary version, 10:10837 (R;US)
Design basis memorandum. Volume 1. Nonproprietary version, 10:10839 (R;US)
Design
6000 tpd SRC-I Demonstration Plant: Plant Availability Study and Utilization Model non-proprietary version, 10:10837 (R;US)
Design basis memorandum. Volume 1. Nonproprietary version, 10:10839 (R;US)
Optimization
6000 tpd SRC-I Demonstration Plant: Plant Availability Study and Utilization Model non-proprietary version, 10:10837 (R;US)
Organic Solvents
Process-related effects on chemical composition of direct coal liquefaction materials, 10:10862 (R;US)
Process Solutions
Process-related effects on chemical composition of direct coal liquefaction materials, 10:10862 (R;US)
Research Programs
Process R and D plan: Post-Baseline Research and Technology Subcontract Programs (Task 203), 10:10838 (R;US)

STABILITY (REACTOR)
See REACTOR STABILITY

STAINLESS STEEL-304
Creep
Creep crack growth in ductile alloys, 10:11332 (R;US)
Mechanical Tests
1.2 Mbar shock loaded 304 stainless steel: residual structure and properties, 10:11365 (BA;US)
Shock Waves
1.2 Mbar shock loaded 304 stainless steel: residual structure and properties, 10:11365 (BA;US)

STAINLESS STEEL-316
Physical Radiation Effects
Influence of titanium on the neutron-induced swelling of austenitic alloys, 10:11336 (R;US)
Welded Joints
Deformation behavior of a 16-8-2 GTA weld as influenced by its solidification substructure, 10:11370 (J;US)

STAINLESS STEELS
See also STAINLESS STEEL-304
STAINLESS STEEL-316
Bonding
Use of electrodeposition to provide coatings for solid state bonding, 10:11384 (J;US)
Corrosion
Test methods to predict long-term corrosion of container materials in repositories, 10:11345 (R;US)
Corrosion Resistance
Corrosion resistance of metallic solar absorber materials in a range of heat transfer fluids. Final technical report, 10:11055 (R;US)
Effect of neutralization on protectiveness of sulfide films on carbon steel, 10:11007 (J;US)
Diffusion Welding
Use of electrodeposition to provide coatings for solid state bonding, 10:11384 (J;US)
Pitting Corrosion
Local electrochemistry of pitting corrosion in stainless steels, 10:11325 (R;US)
Protective Coatings
Effect of neutralization on protectiveness of sulfide films on carbon steel, 10:11007 (J;US)

STANDING CROP
See BIOMASS

STANFORD LINEAR ACCELERATOR CENTER
Computerized Control Systems
Performance report for Stanford/SLAC Microstore Analog Memory Unit, 10:11552 (R;US)
Data Acquisition Systems
SLAC Scanner Processor: a FASTBUS module for data collection and processing, 10:11554 (R;US)
Operation
Stanford Linear Accelerator Center monthly report for November 1984, 10:11546 (R;US)
Research Programs
Stanford Linear Accelerator Center monthly report for November 1984, 10:11546 (R;US)

STANFORD LINEAR COLLIDER
Accelerator Facilities
Cerenkov ring imaging detector development for SLD, 10:11570 (R;US)
Drift Chambers
New drift chamber for the Mark II detector at the SLAC Linear Collider, 10:11568 (R;US)
SLAC Mark II upgrade drift chamber front end electronics, 10:11569 (R;US)
Timing Circuits
Vernier Delay Unit, 10:11553 (R;US)

STEAM GENERATORS
Corrosion Products
Generation and behavior of metal oxide colloids in PWR steam systems, 10:11097 (R;US)
Materials Testing
Evaluation of alternative alloys for PWR steam generator tubing. Final report, 10:11096 (R;US)
Meetings
Workshop proceedings: pitting in steam generator tubing, 10:11095 (R;US)
Pitting Corrosion
Workshop proceedings: pitting in steam generator tubing, 10:11095 (R;US)

STEAM INJECTION
Bench-Scale Experiments
Contracts for field projects and supporting research on enhanced oil recovery. Progress Review No. 39, quarter ending June 30, 1984, 10:10935 (R;US)

Field Tests
Contracts for field projects and supporting research on enhanced oil recovery. Progress Review No. 39, quarter ending June 30, 1984, 10:10935 (R;US)

STEEL INDUSTRY
See METAL INDUSTRY

STEEL-ASTM-A533-B
Fracture Properties
Between-heats charpy energy and initiation fracture toughness variation of SA533B-1, 10:11373 (J;US)

STEEL-DIN-1-4981
Physical Radiation Effects
Irradiation-induced creep and swelling of austenitic material No. 1.4981 between 400 and 500°C (RIPCEX I), 10:11385 (TJ;GB)

STEELS
See also CARBON STEELS
STAINLESS STEELS
Bonding
Use of electrodeposition to provide coatings for solid state bonding, 10:11384 (J;US)
Chemical Vapor Deposition
Chemical vapour deposition coating of hard metals with special reference to boron and boron compounds, 10:11343 (R;GB)
Corrosion Resistance
Effect of neutralization on protectiveness of sulfide films on carbon steel, 10:11007 (J;US)
Diffusion Welding
Use of electrodeposition to provide coatings for solid state bonding, 10:11384 (J;US)
Protective Coatings
Effect of neutralization on protectiveness of sulfide films on carbon steel, 10:11007 (J;US)

STEM CELLS
Biological Radiation Effects
Relative biological effectiveness measurements using murine lethality and survival of intestinal and hematopoietic stem cells after Fermilab neutrons compared to JANUS reactor neutrons and ^{60}Co gamma rays, 10:11681 (J;US)

STIMULATED EMISSION DEVICES
See LASERS

STIRLING ENGINES
Losses
Effect of water on hydrogen permeability, 10:11317 (R;US)
Permeability
Effect of water on hydrogen permeability, 10:11317 (R;US)

STORAGE BATTERIES
See ELECTRIC BATTERIES

STORAGE DEVICES (DATA)
See MEMORY DEVICES

STORAGE FACILITIES
Cost
High temperature gas reactor and energy pipeline system, 10:11178 (J;ZZ)
Design
High temperature gas reactor and energy pipeline system, 10:11178 (J;ZZ)

STORAGE RINGS
See also PEP STORAGE RINGS
PETRA STORAGE RING
SUPERCONDUCTING SUPER COLLIDER
Permanent Magnets
Application of permanent magnets in accelerators and electron storage rings, 10:11532 (R;US)

STORAGE (SPENT FUEL)
See SPENT FUEL STORAGE

STORES
See COMMERCIAL BUILDINGS

STORMS
Mathematical Models
PLUVIUS: a generalized one-dimensional model of reactive pollutant behavior, including dry deposition, precipitation formation, and wet removal. Second edition, 10:11592 (R;US)

STOVES
Heat Storage
Improving the thermal conductivity and storage capacity of European type ceramic tile stoves using olivine, July 15, 1982-June 31, 1984, 10:11288 (R;US)
Indoor Air Pollution
Tennessee Valley Authority/Bonneville Power Administration indoor air quality study. Volume I, 10:11596 (R;US)

STRATOSPHERE
Nitric Oxide
Stratospheric NO and NO2 profiles at sunset from analysis of high-resolution balloon-borne infrared solar absorption spectra obtained at 33 deg N and calculations with a time-dependent photochemical model, 10:11589 (R;US)
Nitrogen Dioxide
Stratospheric NO and NO2 profiles at sunset from analysis of high-resolution balloon-borne infrared solar absorption spectra obtained at 33 deg N and calculations with a time-dependent photochemical model, 10:11589 (R;US)

STREAMS
Sampling
Evaluation of existing data on discharges from active coal mines in Illinois, 10:10884 (RA;US)
Water Quality
Chemical quality of the saturated zone associated with contour surface mining spoil and its effect on stream water quality, 10:10883 (RA;US)
Evaluation of existing data on discharges from active coal mines in Illinois, 10:10884 (RA;US)

STREETS
See ROADS

STRENGTH (FRACTURE)
See FRACTURE PROPERTIES

STRIPPER FOILS
See BEAM STRIPPERS

STRIPPERS
See BEAM STRIPPERS

STRONG INTERACTIONS
Coupling Constants
Measurements of energy correlations in e^+e^- -> hadrons, 10:11814 (R;DE)
Some comments on α/sub s/ and Λ/sub anti MS/, 10:11841 (R;US)

STRONTIUM
Adsorption
Characterization of soils at proposed Solid Waste Storage Area (SWSA) 7, 10:11625 (R;US)
Solubility
Groundwater chemistry along flow paths between a proposed repository site and the accessible environment, 10:11000 (R;US)
Solvent Extraction
Investigations of ion-size-selective synergism in solvent extraction, 10:11433 (J;US)

STRONTIUM 85
Adsorption
Strontium sorption on Savannah River Plant soils, 10:10999 (R;US)
Uptake
Relationship between burial depth and radiocesium and radiostrontium and their accumulation in crop plants, 10:11621 (R;US)

STRONTIUM 90
Ion Exchange
Studies of cation exchange for the isolation and concentration of trace level components of complex aqueous mixtures, 10:10974 (R;US)

STRUCTURES (BUILDINGS)
See BUILDINGS

STUDS
See FASTENERS

SUBBITUMINOUS COAL
Dissolution
Coal liquefaction research. Quarterly report, April-June 1984, 10:10849 (R;US)

SUBSIDENCE (GROUND)
See GROUND SUBSIDENCE
SULFONIC ACID ESTERS
See also METHYL METHANESULFONATE
Biological Effects
Excision repair of ultraviolet- and chemically-induced damage in the DNA of fibroblasts derived from two closely related species of marine fishes, 10:11701 (J;NL)
SULFONIC ACIDS
Gas Chromatography
Identification of lignosulfonic acid and humic acid by pyrolysis, gas chromatography and mass spectrometry (Py-GC-MS), 10:11437 (TG;US)
Mass Spectroscopy
Identification of lignosulfonic acid and humic acid by pyrolysis, gas chromatography and mass spectrometry (Py-GC-MS), 10:11437 (TG;US)
Pyrolysis
Identification of lignosulfonic acid and humic acid by pyrolysis, gas chromatography and mass spectrometry (Py-GC-MS), 10:11437 (TG;US)
SULFUR
Absorption Spectra
Effect of pressure on the optical absorption edge of sulfur to 300 kbar, 10:11421 (J;US)
Metallurgical Effects
Chemical state investigation of grain boundary segregated sulfur in polycrytstalline nickel, 10:11380 (J;US)
Oscillator Strengths
H-Division materials physics quarterly report, April-June 1984, 10:11323 (R;US)
Oxidation
Desulfurization of coal slurries by electrolysis, 10:10909 (RA;US)
SULFUR 34
Mass Spectroscopy
Isotopic analysis of enriched/depleted SO_2 via low-resolution mass sectrometry, 10:11429 (R;US)
SULFUR COMPOUNDS
See also CARBON OXYSULFIDE
SULFUR FLUORIDES
Oxidation
Voltammetric study of the anodic oxidation of sulfide ions in molten fluorides, 10:11466 (J;US)
SULFUR DIOXIDE
Chemical Analysis
Isotopic analysis of enriched/depleted SO_2 via low-resolution mass sectrometry, 10:11429 (R;US)
Sorption
[Evaluation of NOXSO combined NO/sub x/ and SO_2 flue gas cleanup]. Monthly progress report, April 1-30, 1983, 10:10865 (R;US)
Evaluation of the NOXSO combined NO/sub x//SO_2 flue gas treatment process: process chemistry, reaction kinetics and sorbent performance. Monthly progress report, March 1, 1983-March 31, 1983, 10:10864 (R;US)
SULFUR FLUORIDES
Energy Levels
Patterns of energy levels and spectra for polyatomic molecules, 10:11799 (J;US)
Hyperfine Structure
Patterns of energy levels and spectra for polyatomic molecules, 10:11799 (J;US)
Infrared Spectra
Pulse expansion deposits and orientational ordering for low temperature matrices, 10:11772 (J;US)
Matrix Isolation
Pulse expansion deposits and orientational ordering for low temperature matrices, 10:11772 (J;US)
Orientation
Pulse expansion deposits and orientational ordering for low temperature matrices, 10:11772 (J;US)
SULFUR HYDRIDES
See HYDROGEN SULFIDES
SULFUR SULFIDES
See SULFUR
SUPERALLOYS
See HEAT RESISTING ALLOYS
SUPERCOMPUTERS
Architecture
Future database machine architectures, 10:12007 (R;US)
SUPERCONDUCTING CABLES
Electrical Insulation
Superconducting power transmission system development. Cable insulation development. Semiannual report, 1 October 1983-31 March 1984, 10:11069 (R;US)
Power Transmission Lines
Superconducting power transmission system development. Cable insulation development. Semiannual report, 1 October 1983-31 March 1984, 10:11069 (R;US)
Thermal Insulation
Superconducting power transmission system development. Cable insulation development. Semiannual report, 1 October 1983-31 March 1984, 10:11069 (R;US)
SUPERCONDUCTING CAVITY RESONATORS
Diffusion Coating
Production and testing of an s-band resonator with a Nb_3Sn surface, 10:11555 (R;DE;In German)
Performance Testing
Production and testing of an s-band resonator with a Nb_3Sn surface, 10:11555 (R;DE;In German)
SUPERCONDUCTING JUNCTIONS
See also JOSEPHSON JUNCTIONS
Superconducting junction with resonant tunneling, 10:11913 (R;US)
SUPERCONDUCTING MAGNETS
Materials Testing
Special purpose materials for fusion application, 10:11974 (R;US)
SUPERCONDUCTING SUPER COLLIDER
Beam Injection
Summary report: injection group, 10:11536 (R;US)
Colliding Beams
pp Interaction Regions (Superconducting super collider), 10:11537 (R;US)
Experiment Planning
Physics at $10^{34}\,cm^{-2}\,s^{-1}$, 10:11813 (R;US)
pp Interaction Regions (Superconducting super collider), 10:11537 (R;US)
Feasibility Studies
Summary report: injection group, 10:11536 (R;US)
Planning
Super-collider: progress, options and physics, 10:11529 (R;US)
Radiation Detectors
Physics at $10^{34}\,cm^{-2}\,s^{-1}$, 10:11813 (R;US)
Secondary Beams
Estimate of particle fluxes from the IR's at the SSC, 10:11534 (R;US)
SUPERCONDUCTIVITY
Transition Temperature
Electronic properties of new organic conductors ((BEDT-TTF)$_2$BrO$_4$, (BEDT-TTF)$_2$I$_3$), 10:11411 (R;US)
SUPERCONDUCTORS
Electron-Phonon Coupling
Superconducting junction with resonant tunneling, 10:11913 (R;US)
Green Function
Eilenberger equations for moderately dirty superconductors, 10:11916 (J;US)
Magnetic Shielding
Zero-quantum superconducting magnetic shield, 10:11491 (BA;US)
Mechanical Properties
Studies of structural properties and their relationship to critical parameters in superconducting materials. Final report 1 October 1979-31 December 1983, 10:11912 (R;US)
Optimization
Optimization of Nb_3Sn, 10:11481 (R;US)
SUPERCRITICAL FLOW
See TURBULENT FLOW
SUPERFUND
Compliance
Status of civilian federal agencies' efforts to address hazardous waste problems on their lands, 10:11187 (R;US)

Legal Aspects
Natural resource damage claims and assessment regulations under Superfund, 10:11188 (R;US)
SUPERLATTICES
Charge Carriers
Light-hole conduction in InGaAs/GaAs strained-layer superlattices, 10:11415 (J;US)
Effective Mass
Light-hole conduction in InGaAs/GaAs strained-layer superlattices, 10:11415 (J;US)
Magnetoresistance
Light-hole conduction in InGaAs/GaAs strained-layer superlattices, 10:11415 (J;US)
Strains
Light-hole conduction in InGaAs/GaAs strained-layer superlattices, 10:11415 (J;US)
Valence
Light-hole conduction in InGaAs/GaAs strained-layer superlattices, 10:11415 (J;US)
SUPERNOVA REMNANTS
Spectra
Imagery and spectroscopy of supernova remnants and H-2 regions, 10:11741 (R;US)
SUPERSYMMETRY
Yang-Mills Theory
Stochastic variables in N=1 supersymmetric Yang-Mills theory, 10:11852 (R;DE)
SUPERVOLTAGE RADIOTHERAPY
See RADIOTHERAPY
SUPPORT PILLARS
Failures
Prediction and monitoring of roof conditions, 10:10901 (R;AU)
Rock Mechanics
Prediction and monitoring of roof conditions, 10:10901 (R;AU)
SUPPORTS (CATALYST)
See CATALYST SUPPORTS
SURFACE MINING
Computerized Simulation
Mining research and development program. Second quarterly report, June 25, 1982-September 25, 1982, 10:10894 (R;US)
Economics
Mining research and development program. Second quarterly report, June 25, 1982-September 25, 1982, 10:10894 (R;US)
Environmental Effects
Conceptual model of ground-water flow in the Eastern Kentucky coal field, 10:10904 (RA;US)
Explosive Fracturing
Coal overburden project, 10:10898 (R;AU)
Land Reclamation
Erosion characteristics of surface-mined soils, 10:10885 (RA;US)
Shrub cover and density on western rangelands in relation to reclamation standards for surface mined lands in Wyoming, 10:10873 (RA;US)
Mine Draining
Prediction of quality and quantity of open pit mine flow from saturated abandoned underground mine workings, 10:10903 (RA;US)
Productivity
Mining research and development program. Second quarterly report, June 25, 1982-September 25, 1982, 10:10894 (R;US)
Roads
New publications for road systems at coal mines, 10:10902 (RA;US)
Spoil Banks
Chemical quality of the saturated zone associated with contour surface mining spoil and its effect on stream water quality, 10:10883 (RA;US)
Evaluation of slope stability and foundation suitability for four southwestern Virginia mine spoils, 10:10875 (RA;US)
Hydrologic characterization of the saturated zone associated with contour surface mining spoil in the New River Basin of Tennessee, 10:10881 (RA;US)
Water Pollution
Chemical quality of the saturated zone associated with contour surface mining spoil and its effect on stream water quality, 10:10883 (RA;US)
SURFACE WATERS
See also COASTAL WATERS
STREAMS
Chemical Analysis
Studies of cation exchange for the isolation and concentration of trace level components of complex aqueous mixtures, 10:10974 (R;US)
Radionuclide Migration
RADTWO: a computer code for simulating fast-transient, two-dimensional, two-layer radionuclide concentration conditions in lakes, reservoirs, rivers, estuaries, and coastal regions, 10:11636 (R;US)
Water Pollution Control
Development of toxic screening models for surface water supplies, 10:11631 (R;US)
SURFACE-ACTIVE AGENTS
See SURFACTANTS
SURFACES
Molecule Collisions
Wave packet approach to inelastic scattering from large targets, 10:11777 (J;US)
SURFACTANTS
Comparative Evaluations
Study of Micellar-Enhanced Ultrafiltration. Progress report, March 1, 1984-February 28, 1985, 10:11427 (R;US)
SUSPENSIONS
Brownian Movement
Application of photon correlation spectroscopy to flowing Brownian motion systems, 10:11807 (J;US)
Mechanical Properties
Theories of immiscible and structured mixtures, 10:11911 (J;GB)
Permeability
Porosity and specific surface for interpenetrable-sphere models of two-phase random media, 10:11921 (J;US)
Porosity
Porosity and specific surface for interpenetrable-sphere models of two-phase random media, 10:11921 (J;US)
SUSPENSIONS (FUEL)
See FUEL SLURRIES
SYNCHROTRON RADIATION
Experiment Planning
Characteristics of synchrotron radiation, 10:11539 (R;US)
SYNCHROTRON RADIATION SOURCES
See also NSLS
Uses
Characteristics of synchrotron radiation, 10:11539 (R;US)
SYNOVIA
See BONE JOINTS
SYNTHESIS GAS
Cleaning
Clean-up of producer and synthesis gas with a tube and wire electrostatic precipitator, 10:11024 (J;GB)

T

TAILINGS
Solid residue separated in the preparation of various products.
Processing
Coal washery reject disposal, 10:10915 (R;AU)
Water Removal
Coal washery reject disposal, 10:10915 (R;AU)
TANDEM ELECTROSTATIC ACCELERATORS
Prior to February 1979,information was indexed to Van de Graaff Accelerators.
Glow Discharges
Observations on the Munich MP arc discharge conditioning test, 10:11530 (R;US)
TANDEM MIRRORS
Prior to September 1983 this concept was indexed to TMX DEVICES.
See also TARA DEVICES

ICR Heating
Monte-Carlo study of ICRF-sustained mode operation in tandem mirrors, 10:11957 (J;AT)
TANK FARMS
See STORAGE FACILITIES
TANKS
Tires
Field measurement of tension in a T-142 tank track, 10:11488 (R;US)
TANTALUM
Coatings
Observation of a first-order phase transition in Xe/Ta(110) by photoelectron spectroscopy, 10:11360 (J;US)
Diffusion
Reaction of amorphous NiNb films with crystalline metal overlayers, 10:11350 (R;US)
Work Functions
Observation of a first-order phase transition in Xe/Ta(110) by photoelectron spectroscopy, 10:11360 (J;US)
TARA DEVICES
Plasma Diagnostics
TARA diagnostic set, 10:11930 (R;US)
TARGETS
See also BERYLLIUM 9 TARGET
CALCIUM 40 TARGET
CARBON 12 TARGET
DEUTERIUM TARGET
ERBIUM 166 TARGET
HELIUM 3 TARGET
HYDROGEN 1 TARGET
LASER TARGETS
MOLYBDENUM 92 TARGET
NICKEL 60 TARGET
NITROGEN 14 TARGET
PLUTONIUM 239 TARGET
PLUTONIUM 241 TARGET
POTASSIUM 39 TARGET
POTASSIUM 41 TARGET
TIN 118 TARGET
URANIUM 233 TARGET
URANIUM 235 TARGET
URANIUM 238 TARGET
Design
Nuclear physics experiments with the ORNL-HHIRF supersonic gas jet target, 10:11868 (R;US)
TATB
Detonations
Initiation studies of TATB-based high explosives, 10:11585 (RA;US)
Ignition
Short-duration shock initiation of triaminotrinitrobenzene (TATB), 10:11583 (BA;NL)
Shock Waves
Short-duration shock initiation of triaminotrinitrobenzene (TATB), 10:11583 (BA;NL)
TAU LEPTONS
See TAU PARTICLES
TAU PARTICLES
Weak Particle Decay
Recent results from PEP, 10:11821 (R;US)
TASSO vertex detector, 10:11557 (R;DE)
TAUONS
See TAU PARTICLES
TECHNETIUM
Adsorption
Progress in evaluation of radionuclide geochemical information developed by DOE high-level nuclear waste repository site projects. Report for January-March 1984, 10:11001 (R;US)
Solubility
Groundwater chemistry along flow paths between a proposed repository site and the accessible environment, 10:11000 (R;US)
Progress in evaluation of radionuclide geochemical information developed by DOE high-level nuclear waste repository site projects. Report for January-March 1984, 10:11001 (R;US)
TECHNETIUM 99
Mass Spectroscopy
Review of applications of mass spectrometry to low level radionuclide metrology, 10:11431 (J;NL)
Radiation Monitoring
Review of applications of mass spectrometry to low level radionuclide metrology, 10:11431 (J;NL)
TEETH
Biomedical Radiography
Experiments for improving the roentgen imaging and thus the caries diagnosis in the approximal space of lateral teeth, 10:11648 (R;DE;In German)
Caries
Experiments for improving the roentgen imaging and thus the caries diagnosis in the approximal space of lateral teeth, 10:11648 (R;DE;In German)
TEM
See ALKYLATING AGENTS
TEMPERATURE NOISE
Calibration Standards
Coaxial noise standard for the 1 GHz to 12.4 GHz frequency range. Final report, 10:11487 (R;US)
TERBIUM 161
Energy Levels
Nuclear data sheets for A = 161, 10:11880 (J;US)
Energy-Level Transitions
Nuclear data sheets for A = 161, 10:11880 (J;US)
TERTIARY RECOVERY
See ENHANCED RECOVERY
TESTING (BIOLOGICAL)
See BIOASSAY
TESTING (MATERIALS)
See MATERIALS TESTING
TETRACHLOROMETHANE
See CARBON TETRACHLORIDE
TETRAFLUOROMETHANE
See CARBON TETRAFLUORIDE
TETRAMETHYLTETRASELENAFULVALENE
See TMTSF
TETRATHIAFULVALENE
See TTF
TEVATRON
Accelerator Facilities
D0 Project at Fermilab, 10:11543 (R;US)
TEXAS
Hydrology
Ogallala Aquifer Mapping Program (Deaf Smith and Swisher counties), 10:10997 (R;US)
TEXAS EXPERIMENTAL TOKAMAK
See TEXT DEVICES
TEXT DEVICES
Radiations
Initial bolometric measurements on text, 10:11931 (R;US)
TFCX REACTORS
Specifications
Materials engineering for TFCX, 10:11975 (R;US)
TFTR REACTORS
Gamma Detection
Fusion gamma diagnostics, 10:11943 (R;US)
Neutron Spectra
Absolute fission chambers for high-energy neutron fields. Final report, 10:11941 (R;US)
THERMAL CONDUCTIVITY
Correlations
H-Division materials physics quarterly report, April-June 1984, 10:11323 (R;US)
Measuring Methods
Hot wire thermal conductivity measurements in high temperature refractories, 10:11391 (R;US)
THERMAL ENERGY STORAGE EQUIPMENT
Performance Testing
10 MWe Solar Thermal Central Receiver Pilot Plant Mode 5: Charging Only acceptance test procedure 1150, 10:11049 (R;US)
THERMAL POLLUTION (AIR)
See AIR POLLUTION
THERMAL POLLUTION (WATER)
See WATER POLLUTION
THERMAL POWER PLANTS
See also FOSSIL-FUEL POWER PLANTS
NUCLEAR POWER PLANTS
OCEAN THERMAL POWER PLANTS

Load Management
Application of MINOS to a thermal ramping problem, 10:11218 (R;US)

THERMAL REACTORS
See also BSR-1 REACTOR
HFR REACTOR
SHOREHAM REACTOR

Control Rod Worths
Blackness coefficients, effective diffusion parameters, and control rod worths for thermal reactors - methods, 10:11129 (R;US)

THERMAL STORAGE
See HEAT STORAGE

THERMOCHEMICAL PROCESSES
See also COMBUSTION

Research Programs
Overview of DOE's biomass thermochemical conversion process, 10:11018 (R;US)

THERMOCOUPLES

Impedance
Thermocouple modeling, 10:11094 (R;US)

THERMOGRAPHY

Comparative Evaluations
Ultrasonic mammography. Value and meaning of the method in comparison to X-ray mammography, thermography, and fine needle biopsy, 10:11655 (R;DE;In German)

THERMONUCLEAR FUELS

Pellet Injection
Pellet fuelling development at Oak Ridge National Laboratory, 10:12002 (BA;GB)

THERMONUCLEAR IGNITION
Capillary discharge thermonuclear burner, 10:11972 (J;IT)

THERMONUCLEAR REACTOR MATERIALS
The materials impact on fusion reactor safety, 10:11990 (J;US)

Materials Testing
Technology development facility (TDF), 10:11999 (BA;GB)

Meetings
Fusion reactor materials. Pt. A. Proceedings, 10:11988 (B;NL)

Radioactivity
Lower activation materials and magnetic fusion reactors, 10:11993 (J;US)

Research Programs
New challenges in fusion research for the materials scientist, 10:11995 (BA;GB)
Special purpose materials for fusion application, 10:11974 (R;US)

THERMONUCLEAR REACTORS
For use in cases where certain aspects of either hypothetical or real thermonuclear reactors are discussed.
See also I-BEAM TYPE REACTORS
TOKAMAK TYPE REACTORS

Design
FED reactor engineering features, 10:12001 (BA;GB)
Lower activation materials and magnetic fusion reactors, 10:11993 (J;US)

Energy Spectra
An analysis of bremsstrahlung energy deposition in magnetic fusion first wall materials, 10:11994 (J;US)

Nuclear Engineering
FED reactor engineering features, 10:12001 (BA;GB)

Planning
Lower activation materials and magnetic fusion reactors, 10:11993 (J;US)

Plasma Confinement
Future technology requirements for magnetic fusion--An evaluation based on conceptual design studies, 10:11989 (J;US)

Reactor Safety
The materials impact on fusion reactor safety, 10:11990 (J;US)

THERMONUCLEAR WEAPONS
See NUCLEAR WEAPONS

THERMOSYPHONS

Fluid Flow
Transient, steady state and stability behavior of a thermosyphon with throughflow, 10:11068 (J;GB)

Heat Transfer
Transient, steady state and stability behavior of a thermosyphon with throughflow, 10:11068 (J;GB)

THIOPHENE

Mutagenesis
Microbial mutagenicity of 3- and 4-ring polycyclic aromatic sulfur heterocycles (Salmonella typhimurium), 10:11702 (J;NL)

THIOPHENES
See POLYCYCLIC SULFUR HETEROCYCLES

THORIUM 230

Spectral Shift
Precision isotope shifts for the heavy elements. III. Singly ionized thorium (Th II), 10:11793 (J;US)

THORIUM 232

Spectral Shift
Precision isotope shifts for the heavy elements. III. Singly ionized thorium (Th II), 10:11793 (J;US)

THORIUM 234

Indoor Air Pollution
Source characterization and transport process affecting levels of radon and its decay products in an indoor environment. Final technical report, 10:11609 (R;US)

THORON
See RADON 220

THULIUM 161

Energy Levels
Nuclear data sheets for A = 161, 10:11880 (J;US)

Energy-Level Transitions
Nuclear data sheets for A = 161, 10:11880 (J;US)

TIGHT SANDS
See SANDSTONES

TIMING CIRCUITS

Delay Circuits
Vernier Delay Unit, 10:11553 (R;US)

TIN 118

Energy Levels
Pion inelastic scattering to giant resonances and low-lying collective states in ^{118}Sn and ^{40}Ca, 10:11878 (J;US)

TIN 118 TARGET

Pion Minus Reactions
Pion inelastic scattering to giant resonances and low-lying collective states in ^{118}Sn and ^{40}Ca, 10:11878 (J;US)

Pion Plus Reactions
Pion inelastic scattering to giant resonances and low-lying collective states in ^{118}Sn and ^{40}Ca, 10:11878 (J;US)

TIN ALLOYS
See also ZIRCALOY

Neutron Diffraction
Paramagnetic scattering from a cubic ferromagnet Pd_2MnSn, 10:11354 (J;US)

TISSUE-EQUIVALENT MATERIALS

Charged-Particle Transport
Mean delta-ray energies in ion-molecule collisions, 10:11900 (R;US)
Monte Carlo calculation of energy deposition and ionization yield for high energy protons, 10:11901 (R;US)

Delta Rays
Mean delta-ray energies in ion-molecule collisions, 10:11900 (R;US)

Neutron Transport
Monte Carlo calculation of energy deposition and ionization yield for high energy protons, 10:11901 (R;US)

TITANATES
Specific compounds, except those of significance to energy research and development, should be indexed by coordination of a descriptor of the form (CATION) COMPOUNDS and the above anion descriptor.

Physical Radiation Effects
Self-radiation damage in actinide host phases of nuclear waste forms ($Ca_2Nd_8(SiO_4)_6O_2$; $Gd_2Ti_2O_7$; $CaZrTi_2O_7$), 10:10981 (R;US)

TITANIUM BASE ALLOYS

Microstructure
Comparison of the microstructures of as-cast and laser surface melted Ti-8Al-4Y, 10:11366 (J;US)

TITANIUM BORIDES
Electric Conductivity
Study of the Kondo effect and intrinsic electrical conduction in titanium diboride, 10:11397 (J;US)
Kondo Effect
Study of the Kondo effect and intrinsic electrical conduction in titanium diboride, 10:11397 (J;US)
TITANIUM CARBIDES
Hot Pressing
Particulate toughened silicon carbide, 10:11404 (R;US)
Sintering
Comparative sinterability of combustion synthesized and commercial titanium carbides, 10:11393 (R;US)
TITANIUM OXIDES
See also RUTILE
Binding Energy
Properties of lanthanide oxides as supports for transition metal catalysts. Progress report, May 1, 1984-April 30, 1985, 10:11441 (R;US)
TMTSF
Electric Conductivity
Transport studies of several novel organic conductors ((BEDT-TTF)$_2$X; (TMTSF)$_2$SiF$_6$), 10:11915 (R;US)
Thermoelectric Properties
Transport studies of several novel organic conductors ((BEDT-TTF)$_2$X; (TMTSF)$_2$SiF$_6$), 10:11915 (R;US)
TOKAMAK DEVICES
See also ALCATOR DEVICE
ASDEX TOKAMAK
TEXT DEVICES
Plasma Diagnostics
Far-infrared laser scattering in the ACT-I toroidal device, 10:11944 (R;US)
Tearing Instability
Linear tearing mode stability for low-q cylindrical tokamaks, 10:11970 (J;GB)
Transport Theory
Collisional transport of momentum in axisymmetric configurations, 10:11961 (J;US)
TOKAMAK FUSION CORE EXPERIMENT
See TFCX REACTORS
TOKAMAK FUSION TEST REACTOR
See TFTR REACTORS
TOKAMAK TYPE REACTORS
See also ISX TOKAMAK
JET REACTORS
TFCX REACTORS
TFTR REACTORS
Design
Tokamak fusion reactors with less than full tritium breeding, 10:11992 (J;US)
Operation
Tokamak fusion reactors with less than full tritium breeding, 10:11992 (J;US)
Performance
System studies for a quasi-steady-state Advanced Physics Tokamak/, 10:11991 (J;US)
TOLUENE
Pyrolysis
Identification and temporal behavior of radical intermediates formed during the combustion and pyrolysis of gaseous fuels: kinetic pathways to soot formation. Progress report, September 1, 1982-June 30, 1985, 10:11475 (R;US)
TONSILS
See LYMPHATIC SYSTEM
TOTAL-ABSORPTION SPECTROMETERS
See SHOWER COUNTERS
TOUGHNESS (FRACTURE)
See FRACTURE PROPERTIES
TOXIC MATERIALS
Bioassay
Characterization of chemical waste site contamination and its extent using bioassays, 10:11618 (R;US)
Environmental Transport
Mobility of toxic compounds from hazardous wastes. Report for January 1982-December 1983, 10:11190 (R;US)
TRACE ELEMENTS
See ELEMENTS
TRACHEA
Pathological Changes
Open-ended rat tracheal implant model: toxic effects of formaldehyde on the respiratory epithelium, 10:11699 (J;NL)
TRANSDUCERS
Design
Mechanically assembled non-bonded tranducers utilizing PVDF film, 10:11513 (R;US)
TRANSFER (HEAT)
See HEAT TRANSFER
TRANSFORMATIONS (ONCOGENIC)
See ONCOGENIC TRANSFORMATIONS
TRANSFORMATIONS (PHASE)
See PHASE TRANSFORMATIONS
TRANSIENTS
Computer Codes
Mechanistic accumulator model for light water reactor transient analysis (RELAP5), 10:11154 (R;US)
Heat Transfer
BEAGL-01: a computer code for calculating rapid LWR core transients. Volume 2. User's manual, 10:11160 (R;US)
RETRAN-02: a program for Transient Thermal-hydraulic Analysis of Complex Fluid Flow Systems. Volume 3. User's manual. Revision 2, 10:11174 (R;US)
RETRAN-02: a program for Transient Thermal-hydraulic Analysis of Complex Fluid Flow systems. Volume 2. Programmer's manual. Revision 2 (PWR; BWR), 10:11175 (R;US)
Hydraulics
BEAGL-01: a computer code for calculating rapid LWR core transients. Volume 2. User's manual, 10:11160 (R;US)
RETRAN-02: a program for Transient Thermal-hydraulic Analysis of Complex Fluid Flow Systems. Volume 3. User's manual. Revision 2, 10:11174 (R;US)
RETRAN-02: a program for Transient Thermal-hydraulic Analysis of Complex Fluid Flow systems. Volume 2. Programmer's manual. Revision 2 (PWR; BWR), 10:11175 (R;US)
Reactor Kinetics
BEAGL-01: a computer code for calculating rapid LWR core transients. Volume 2. User's manual, 10:11160 (R;US)
TRANSITION ELEMENTS
See also CHROMIUM
COBALT
COPPER
GOLD
IRON
MANGANESE
MOLYBDENUM
NICKEL
NIOBIUM
RHENIUM
SILVER
TANTALUM
TECHNETIUM
TUNGSTEN
YTTRIUM
ZIRCONIUM
Adhesion
H-Division materials physics quarterly report, April-June 1984, 10:11323 (R;US)
Electronic Structure
Ab initio effective core potentials for molecular calculations. Potentials for the transition metal atoms Sc to Hg, 10:11778 (J;US)
Wave Functions
Ab initio effective core potentials for molecular calculations. Potentials for the transition metal atoms Sc to Hg, 10:11778 (J;US)
TRANSITION METALS
See TRANSITION ELEMENTS
TRANSITIONS (PHASE)
See PHASE TRANSFORMATIONS
TRANSMISSION (DATA)
See DATA TRANSMISSION
TRANSMISSION (HEAT)
See HEAT TRANSFER
TRANSPORT
Limited to the movement of goods and persons.

Regulations
Safety regulations for coal and oil shale mines, Moscow - 1973, Chapter IV: Road haulage and shaft winding. 2. Manriding and transport of persons and material in level workings , 10:10919 (TG;GB)

TRANSPORT (CHARGED-PARTICLE)
See CHARGED-PARTICLE TRANSPORT

TRANSPORT (GAMMA)
See PHOTON TRANSPORT

TRANSPORT (NEUTRON)
See NEUTRON TRANSPORT

TRANSPORT (PHOTON)
See PHOTON TRANSPORT

TRANSPORT THEORY
Computer Codes
User's guide for TWODANT: a code package for two-dimensional, diffusion-accelerated, neutral-particle transport. Revision 1, 10:11899 (R;US)

TRANSPORTATION SECTOR
Energy Conservation
Introduction and background, 10:11282 (RA;US)
Potential for energy conservation in Dakar transportation system, 10:11301 (RA;US)
Transportation/energy analysis: principles and practice, 10:11300 (RA;US)

TRANSPORTATION SYSTEMS
See also MASS TRANSIT SYSTEMS
Constraints
Disaggregating regional energy supply/demand and flow data to 173 BEAs in support of the national energy transportation study. Final report (In USA by pipeline, rail, truck and barge; potential bottlenecks between 1955 to 1995), 10:11210 (R;US)
Energy Efficiency
Transportation/energy analysis: principles and practice, 10:11300 (RA;US)
Mathematical Models
Disaggregating regional energy supply/demand and flow data to 173 BEAs in support of the national energy transportation study. Final report (In USA by pipeline, rail, truck and barge; potential bottlenecks between 1955 to 1995), 10:11210 (R;US)

TRANSURANIUM WASTES
See ALPHA-BEARING WASTES

TRETAMINE
See ALKYLATING AGENTS

1,3,5-TRIAMINO-2,4,6-TRINITROBENZENE
See TATB

TRIETHYLENEMELAMINE
See ALKYLATING AGENTS

TRIPLET PARTICLES
See QUARKS

TRITIUM
Breeding
Tokamak fusion reactors with less than full tritium breeding, 10:11992 (J;US)
Diffusion
Tritium permeation and recovery for the helium-cooled molten salt fusion breeder, 10:11983 (R;US)
Radiochemical Analysis
Tritium analysis of the Tatum Salt Dome Area, 10:11635 (R;US)

TRITIUM RECOVERY
In thermonuclear reactors and/or devices.
Tritium permeation and recovery for the helium-cooled molten salt fusion breeder, 10:11983 (R;US)

TROILITE
Catalytic Effects
Structure-sensitive catalytic dehydrogenation of hydrogen donor over iron sulfides: new methods for increasing coal depolymerization under mild conditions, 10:11443 (RA;US)

TROPOSPHERE
Aerosols
Background Tropospheric Aerosols: Incorporation within a statistical-dynamical climate model, 10:11601 (J;US)

TRU WASTES
See ALPHA-BEARING WASTES

TRUCKS
Electric-Powered Vehicles
Fuel cell power system for forklift trucks, 10:11258 (RA;US)

TRUST TERRITORY OF THE PACIFIC ISLANDS
Energy Source Development
Biomass energy options for the American Territories of the Pacific, 10:11223 (R;US)

TRX-1
See REVERSE-FIELD PINCH

TSL PROCESS
Organic Solvents
Process-related effects on chemical composition of direct coal liquefaction materials, 10:10862 (R;US)
Process Solutions
Process-related effects on chemical composition of direct coal liquefaction materials, 10:10862 (R;US)

TTF
Electric Conductivity
Transport studies of several novel organic conductors ($(BEDT\text{-}TTF)_2X$; $(TMTSF)_2SiF_6$), 10:11915 (R;US)
Thermoelectric Properties
Transport studies of several novel organic conductors ($(BEDT\text{-}TTF)_2X$; $(TMTSF)_2SiF_6$), 10:11915 (R;US)

TUBES (CONDUITS)
See PIPES

TUFF
Corrosive Effects
Test methods to predict long-term corrosion of container materials in repositories, 10:11345 (R;US)
Equations of State
H-Division materials physics quarterly report, April-June 1984, 10:11323 (R;US)
Heat Transfer
Application of far-field models to the disposal of nuclear waste in geologic formations, 10:10991 (R;US)
Mechanical Properties
Geoengineering properties of potential repository units at Yucca Mountain, southern Nevada, 10:10989 (R;US)
Temperature Effects
Application of far-field models to the disposal of nuclear waste in geologic formations, 10:10991 (R;US)
Thermal Stresses
Application of far-field models to the disposal of nuclear waste in geologic formations, 10:10991 (R;US)
Thermodynamic Properties
Geoengineering properties of potential repository units at Yucca Mountain, southern Nevada, 10:10989 (R;US)

TUMORS
See NEOPLASMS

TUNGSTEN
Deposition
Positron reemission: measurement of thin single crystal W(100) films to be used as transmission moderator or re-moderators, 10:11761 (R;US)
Electron Collisions
Interaction of low energy electrons with surface lattice vibrations. Final report, 10:11764 (R;US)
Lattice Vibrations
Interaction of low energy electrons with surface lattice vibrations. Final report, 10:11764 (R;US)
Point Defects
Quantitative study of vacancy defects in quenched tungsten by combined field-ion microscopy and electrical resistometry, 10:11374 (J;GB)
Positrons
Positron reemission: measurement of thin single crystal W(100) films to be used as transmission moderator or re-moderators, 10:11761 (R;US)

TUNNEL EFFECT
Quantum Mechanics
Macroscopic quantum tunnelling in a current biased Josephson junction, 10:11914 (R;US)

TURBULENT FLOW
Intermittency and attractor size in isotropic turbulence, 10:11805 (J;US)

TWO-PHASE FLOW
Flow Models
Geometric analysis of the solutions of two-phase flows: two-fluid model, 10:11802 (R;US)
Mathematical Models
Two-phase flow: Models and methods, 10:11510 (J;US)

U

UCLLL
See LAWRENCE LIVERMORE LABORATORY
U-GAS PROCESS
Commercialization
Role of pilot plants in the development of U-Gas commercial reactor design, 10:10829 (R;US)
Pilot Plants
Role of pilot plants in the development of U-Gas commercial reactor design, 10:10829 (R;US)
UJM
See JET MODEL
ULTRAFILTRATION
Reagents
Study of Micellar-Enhanced Ultrafiltration. Progress report, March 1, 1984-February 28, 1985, 10:11427 (R;US)
ULTRASONIC TESTING
Transducers
Mechanically assembled non-bonded tranducers utilizing PVDF film, 10:11513 (R;US)
ULTRASONOGRAPHY
Comparative Evaluations
Ultrasonic mammography. Value and meaning of the method in comparison to X-ray mammography, thermography, and fine needle biopsy, 10:11655 (R;DE;In German)
ULTRAVIOLET RADIATION
See also FAR ULTRAVIOLET RADIATION
Biological Effects
Excision repair of ultraviolet- and chemically-induced damage in the DNA of fibroblasts derived from two closely related species of marine fishes, 10:11701 (J;NL)
Inducible reactivation of bacteriophage T7 damaged by methyl methanesulfonate or UV light, 10:11689 (J;US)
New techniques for growing anaerobic bacteria: experiments with Clostridium butyricum and Clostridium acetobutylicum, 10:11663 (J;US)
Mutagenesis
Rapid changes in deoxynucleoside triphosphate pools in mammalian cells treated with mutagens, 10:11692 (J;US)
UNCORRELATED-JET MODEL
See JET MODEL
UNDERGROUND GASIFICATION
See IN-SITU GASIFICATION
UNDERGROUND MINING
See also LONGWALL MINING
ROOM AND PILLAR MINING
Abandoned Sites
Prediction of quality and quantity of open pit mine flow from saturated abandoned underground mine workings, 10:10903 (RA;US)
Belt Conveyors
Detection of fire hazards in belt conveyors in coal mines, 10:10905 (TG;GB)
Ground Subsidence
Economic effects of subsidence from underground coal mining on agricultural land in Illinois. Open file report, 1 September 1982-30 November 1984, 10:10879 (R;US)
Mining Engineering
Geomechanical evaluation of alternative underground mining methods, 10:10899 (R;AU)
Ventilation
Mine ventilation subsequent to explosions and fires, 10:10897 (R;AU)
Water Influx
Prediction of quality and quantity of open pit mine flow from saturated abandoned underground mine workings, 10:10903 (RA;US)
UNDERGROUND POWER TRANSMISSION
Performance
Evaluation of underground dc transmission systems. Final report, 10:11070 (R;US)
Superconducting Cables
Superconducting power transmission system development. Cable insulation development. Semiannual report, 1 October 1983-31 March 1984, 10:11069 (R;US)
UNDERGROUND SPACE
Computerized Tomography
Computerized underground image reconstruction. Progress report, July 15, 1982-April 15, 1983, 10:11483 (R;US)
Image Processing
Computerized underground image reconstruction. Progress report, July 15, 1982-April 15, 1983, 10:11483 (R;US)
UNIFIED GAUGE MODELS
See also WEINBERG-SALAM GAUGE MODEL
Standard model and beyond, 10:11853 (R;US)
Meetings
Gauge theories, massive neutrinos, and proton decay, 10:11812 (B;US)
Research Programs
Technical progress report, November 1, 1983-October 31, 1984, 10:11839 (R;US)
UNITED STATES OF AMERICA
See USA
UNIVERSE
Density
Origin of cosmological density fluctuations, 10:11739 (R;US)
Matter
Phase transitions and dark matter problems, 10:11737 (R;US)
UNIVERSITIES
See EDUCATIONAL FACILITIES
URANIUM
See also DEPLETED URANIUM
Adsorption
Geochemical information for sites contaminated with low-level radioactive wastes: II. St. Louis Airport Storage Site, 10:11003 (R;US)
Progress in evaluation of radionuclide geochemical information developed by DOE high-level nuclear waste repository site projects. Report for January-March 1984, 10:11001 (R;US)
Environmental Effects
Environmental assessment: DOE program to improve uranium utilization in light water reactors, 10:11125 (R;US)
Environmental Impacts
Environmental assessment: DOE program to improve uranium utilization in light water reactors, 10:11125 (R;US)
Fuel Management
Environmental assessment: DOE program to improve uranium utilization in light water reactors, 10:11125 (R;US)
Solubility
Groundwater chemistry along flow paths between a proposed repository site and the accessible environment, 10:11000 (R;US)
Progress in evaluation of radionuclide geochemical information developed by DOE high-level nuclear waste repository site projects. Report for January-March 1984, 10:11001 (R;US)
URANIUM 233 TARGET
Neutron Reactions
Least squares fit of thermal data for fissile nuclei, 10:11881 (R;US)
URANIUM 234
Half-Life
Final results of the internal ^{235}U sample intercomparison and the half-life of ^{234}U, 10:11882 (R;US)
URANIUM 235
Mass
Final results of the internal ^{235}U sample intercomparison and the half-life of ^{234}U, 10:11882 (R;US)

Mass Spectroscopy
Review of applications of mass spectrometry to low level radionuclide metrology, 10:11431 (J;NL)
Measuring Methods
Determination of the U-235-content in UF_6 within the shipment container, 10:11005 (RA;DE)
Radiation Monitoring
Review of applications of mass spectrometry to low level radionuclide metrology, 10:11431 (J;NL)

URANIUM 235 TARGET
Neutron Reactions
Least squares fit of thermal data for fissile nuclei, 10:11881 (R;US)

URANIUM 236
Mass Spectroscopy
Review of applications of mass spectrometry to low level radionuclide metrology, 10:11431 (J;NL)
Radiation Monitoring
Review of applications of mass spectrometry to low level radionuclide metrology, 10:11431 (J;NL)

URANIUM 238
Electron Reactions
Coincidence electron scattering (e,e'f) and multipole strength functions in ^{238}U, 10:11885 (J;US)

URANIUM 238 TARGET
Argon 40 Reactions
Reaching the capacity of a composite nucleus for energy and spin containment, 10:11886 (J;US)
Proton Reactions
Inclusive pion production in 330, 400, and 500 MeV proton-nucleus collisions, 10:11870 (J;US)

URANIUM ALLOYS
Electric Conductivity
Phase stability and magnetic properties of UAl_2 based pseudobinary spin fluctuation compounds, 10:11341 (R;US)
Magnetic Susceptibility
Phase stability and magnetic properties of UAl_2 based pseudobinary spin fluctuation compounds, 10:11341 (R;US)
Microstructure
Beta-to-alpha phase transformation in a uranium alloy, 10:11352 (R;US)
Phase Diagrams
Beta-to-alpha phase transformation in a uranium alloy, 10:11352 (R;US)
Phase Stability
Phase stability and magnetic properties of UAl_2 based pseudobinary spin fluctuation compounds, 10:11341 (R;US)
Phase Transformations
Beta-to-alpha phase transformation in a uranium alloy, 10:11352 (R;US)
Specific Heat
Phase stability and magnetic properties of UAl_2 based pseudobinary spin fluctuation compounds, 10:11341 (R;US)

URANIUM COMPOUNDS
See also URANIUM OXIDES
URANIUM PHOSPHIDES
Magnetic Susceptibility
Effect of pressure on spin fluctuations and superconductivity in heavy-fermion UPt_3, 10:11357 (J;US)
Specific Heat
Superconductivity in uranium compounds with Cu_3Au structure, 10:11355 (J;US)
Superconductivity
Effect of pressure on spin fluctuations and superconductivity in heavy-fermion UPt_3, 10:11357 (J;US)
Superconductivity in uranium compounds with Cu_3Au structure, 10:11355 (J;US)

URANIUM DIOXIDE
Permeability
Oxygen diffusion in uranium oxide: an overview, 10:11402 (J;CH)

URANIUM HEXAFLUORIDE
Chemical Reaction Kinetics
Reactions of methyl and ethyl radicals with uranium hexafluoride, 10:11470 (J;US)
Photolysis
Reactions of uranium hexafluoride photolysis products, 10:11469 (J;US)
Uranium 235
Determination of the U-235-content in UF_6 within the shipment container, 10:11005 (RA;DE)

URANIUM II
See URANIUM 234

URANIUM IONS
Beam Strippers
Charge changing cross sections of relativistic uranium, 10:11551 (R;US)
Charge State
Charge changing cross sections of relativistic uranium, 10:11551 (R;US)

URANIUM OXIDES
See also URANIUM DIOXIDE
Atmospheric Chemistry
Application of quantum chemistry of atmospheric chemistry. Annual report, 1 October 1983-30 September 1984, 10:11438 (R;US)
Crystal Field
Neutron scattering investigation of magnetic excitations at high energy transfers, 10:11389 (R;US)
Magnetic Susceptibility
Neutron scattering investigation of magnetic excitations at high energy transfers, 10:11389 (R;US)
Thermochemical Diagrams
Thermochemical modeling of the plutonium and uranium-plutonium dioxides, 10:11440 (R;US)

URANIUM PHOSPHIDES
Magnetic Properties
Critical magnetic behavior of triuranium tetraphosphide U_3P_4, 10:11403 (J;DE)

URANIUM X 1
See THORIUM 234

URANYL NITRATES
Denitration
Apparatus for denitration of uranyl nitrate and/or plutonium nitrate, 10:10956 (TG;US)

URINALYSIS
See URINE

URINE
Radioactivity
Tritium analysis of the Tatum Salt Dome Area, 10:11635 (R;US)

UROGENITAL SYSTEM DISEASES
Diagnosis
Value of lymphography in the diagnosis of urological tumors, 10:11652 (R;DE;In German)

US DOD
Information Systems
Government acronyms and alphabetic organizational designations used in DTIC (Defense Technical Information Center), 10:12030 (R;US)

US DOE
See also ANL
BNL
ECONOMIC REGULATORY ADMINISTRATION
HANFORD RESERVATION
HAPO
IDAHO CHEMICAL PROCESSING PLANT
IDAHO NATIONAL ENGINEERING LABORATORY
LAWRENCE LIVERMORE LABORATORY
NEVADA TEST SITE
NIPER
OAK RIDGE RESERVATION
ORGDP
ORNL
SAVANNAH RIVER PLANT
STANFORD LINEAR ACCELERATOR CENTER
WIPP
Y-12 PLANT
Classified Information
CG-DAR-1: Guide to the declassified areas of nuclear energy research, 10:12024 (R;US)
Construction
Schedule planning for construction projects, 10:12004 (R;US)
Contracts
Department of Energy annual procurement and federal assistance report, FY 1984, 10:12003 (R;US)

Demonstration Programs
Geothermal research and development activities of the U.S. Department of Energy, 10:11225 (BA;NZ)
Grants
Appropriate Technology Small Grants Program: an evaluation. Volume I. Report, 10:11220 (R;US)
Appropriate Technology Small Grants Program: an evaluation. Volume II. Appendix, 10:11221 (R;US)
Department of Energy annual procurement and federal assistance report, FY 1984, 10:12003 (R;US)
Nuclear Energy
Funding of generic activities within DOE's Office of Assistant Secretary for Nuclear Energy, 10:11075 (R;US)
Procurement
Department of Energy annual procurement and federal assistance report, FY 1984, 10:12003 (R;US)
Research Programs
95 stimulations in 63 wells, 10:10951 (J;ZZ)
Appropriate Technology Small Grants Program. Code case studies, 10:11222 (R;US)
Geothermal research and development activities of the U.S. Department of Energy, 10:11225 (BA;NZ)
Impact of electric cars on national energy consumption, 10:11302 (J;US)
Materials Sciences Division long range plan, 10:11322 (R;US)
Summaries of FY 1984 research in high energy physics, 10:11809 (R;US)
Unconventional natural gas, 10:10949 (R;US)
Technology Transfer
Technology Transfer '83. Fiscal year annual report. Research and Development Laboratory technology transfer program, 10:12025 (R;US)

US DOI
Environmental Policy
Natural resource damage claims and assessment regulations under Superfund, 10:11188 (R;US)

US EPA
Environmental Policy
Natural resource damage claims and assessment regulations under Superfund, 10:11188 (R;US)

US ERA
See ECONOMIC REGULATORY ADMINISTRATION

US NRC
United States Nuclear Regulatory Commission-prior to 1975 was part of US AEC.
Nuclear Power Plants
Management weaknesses affect Nuclear Regulatory Commission efforts to address safety issues common to nuclear power plants, 10:11115 (R;US)
Reactor Licensing
Operating reactors licensing actions summary. Vol. 4, No. 10, 10:11116 (R;US)

US ORGANIZATIONS
See also US DOD
US DOE
US DOI
US EPA
US NRC
Waste Disposal
Status of civilian federal agencies' efforts to address hazardous waste problems on their lands, 10:11187 (R;US)

USA
See also AMERICAN SAMOA
TRUST TERRITORY OF THE PACIFIC ISLANDS
Energy Conservation
Industrial energy efficiency reporting: a bridge to information transfer, 10:11211 (BA;CA)
Industry
Industrial energy efficiency reporting: a bridge to information transfer, 10:11211 (BA;CA)
Natural Gas Deposits
Unconventional natural gas, 10:10949 (R;US)
Transportation Systems
Disaggregating regional energy supply/demand and flow data to 173 BEAs in support of the national energy transportation study. Final report (In USA by pipeline, rail, truck and barge; potential bottlenecks between 1955 to 1995), 10:11210 (R;US)

UTERINE CERVIX CARCINOMA
See UROGENITAL SYSTEM DISEASES
UTILITIES
See ELECTRIC UTILITIES

V

VACUUM ULTRAVIOLET RADIATION
See FAR ULTRAVIOLET RADIATION
VALVES
Performance
Experimental investigation of the performance of pressurizer safety valves during single- and two-phase flow (ATWS). Final report, 10:11163 (R;DE;In German)
VAN ALLEN BELTS
See RADIATION BELTS
VANADIUM ALLOYS
Ductility
Ductile ordered intermetallic alloys, 10:11363 (J;US)
Fabrication
Ductile ordered intermetallic alloys, 10:11363 (J;US)
VANADIUM IONS
Ion-Atom Collisions
Resonant electron transfer and excitation in two, three, and four electron sub20Casupq+ and sub23Vsupq+ ions colliding with helium, 10:11781 (J;US)
VANADIUM MINERALS
See MINERALS
VECTOR PROCESSING
Efficiency
Impact of scalar performance on vector and parallel processors, 10:12014 (R;US)
VEGETABLES
Edible parts of plants only; see also FRUITS.
See also SOYBEANS
Drying
Application of the heat pump for concentration by evaporation and for drying in agricultural foodstuffs industries, 10:11312 (TG;GB)
VEGETATION
See PLANTS
VENTILATION
Computerized Simulation
Mine ventilation subsequent to explosions and fires, 10:10897 (R;AU)
VENTILATION DUCTS
See VENTILATION
VERSENE
See EDTA
VESSELS
See CONTAINERS
VESSELS (CHEMICAL REACTIONS)
See CHEMICAL REACTORS
VESSELS (PRESSURE)
See PRESSURE VESSELS
VESSELS (REACTOR)
See REACTOR VESSELS
VIBRATION MODES
See OSCILLATION MODES
VITRINITE
See MACERALS
VOLATILE MATTER
Combustion
Formation of nitrogen oxides from the combustion of Yallourn brown coal, 10:10927 (R;AU)
VOLTAIC CELLS
See ELECTRIC BATTERIES

W

W BOSON
See INTERMEDIATE BOSONS
WASTE ISOLATION PILOT PLANT
See WIPP
WASTE PROCESSING
Environmental Impacts
Effectiveness of regional committees in implementing regional resource recovery programs, 10:11314 (R;US)
Public Opinion
Effectiveness of regional committees in implementing regional resource recovery programs, 10:11314 (R;US)
WASTE TREATMENT
See WASTE PROCESSING
WASTE WATER
Anaerobic Digestion
Energy from municipal waste: assessment of energy conservation and recovery in municipal wastewater treatment, 10:11011 (R;US)
Chemical Analysis
Studies of cation exchange for the isolation and concentration of trace level components of complex aqueous mixtures, 10:10974 (R;US)
WASTES
See also INDUSTRIAL WASTES
MUNICIPAL WASTES
ORGANIC WASTES
RADIOACTIVE WASTES
SOLID WASTES
Materials Recovery
Reducing/separating recoverable demolition wastes with cavitating water jets. Technical report on phase 1, 10:11309 (R;US)
WATER
See also FRESH WATER
GROUND WATER
HEAVY WATER
RAIN WATER
WASTE WATER
Corrosive Effects
Corrosion resistance of metallic solar absorber materials in a range of heat transfer fluids. Final technical report, 10:11055 (R;US)
Energy Transfer
Energy transfer studies between Ne and H_7O, 10:11801 (J;NL)
Radiolysis
Stochastic treatment of fast chemical reactions, 10:11472 (J;US)
Two-Phase Flow
Two-phase flow: Models and methods, 10:11510 (J;US)
WATER COOLANT
See WATER
WATER COOLED REACTORS
See also BWR TYPE REACTORS
HFR REACTOR
LR-0 REACTOR
PWR TYPE REACTORS
Cooling Systems
Application of zone-matching methodology to interacting submerged multiport diffusers, 10:11123 (R;US)
Diffusers
Application of zone-matching methodology to interacting submerged multiport diffusers, 10:11123 (R;US)
Fuel Elements
Principles governing the organization of quality control in the fabrication of water reactor fuel elements, 10:11107 (RA;DE)
Level Indicators
Heated thermocouple liquid level system, 10:11122 (R;US)
Loss of Coolant
Review of experiments to evaluate the ability of electrical heater rods to simulate nuclear fuel rod behavior during postulated loss-of-coolant accidents in light water reactors, 10:11142 (R;US)
Reactor Accidents
Chemical behavior of fission product iodine following LWR accidents, 10:11143 (R;US)
Damage and failure of previously irradiated fuel rods during a reactivity initiated accident, 10:11151 (R;US)
Experimental verification of the behavior of surface flaws in thick-walled steel cylinders during severe thermal shock, 10:11149 (R;US)
FRAP-T5 uncertainty study of five reactor transient and accident events, 10:11150 (R;US)
Transients
Mechanistic accumulator model for light water reactor transient analysis (RELAP5), 10:11154 (R;US)
WATER HYACINTHS
Anaerobic Digestion
Biogasification products of water hyacinth wastewater reclamation, 10:11012 (R;US)
WATER MODERATOR
See WATER
WATER POLLUTION
Environmental progress and challenges: an EPA (Environmental Protection Agency) perspective, 10:11189 (R;US)
WATER TREATMENT
Comparative Evaluations
Simplified modeling of slurry impoundment effluent water quality, 10:10871 (RA;US)
Mathematical Models
Simplified modeling of slurry impoundment effluent water quality, 10:10871 (RA;US)
WATER TREATMENT PLANTS
Energy Recovery
Energy from municipal waste: assessment of energy conservation and recovery in municipal wastewater treatment, 10:11011 (R;US)
WATERBORNE PARTICLES
See PARTICULATES
WATERFLOODING
See also CAUSTIC FLOODING
Field Tests
Contracts for field projects and supporting research on enhanced oil recovery. Progress Review No. 39, quarter ending June 30, 1984, 10:10935 (R;US)
WATERSHEDS
Monitoring
Conceptual model of ground-water flow in the Eastern Kentucky coal field, 10:10904 (RA;US)
WAVE ENERGY CONVERTERS
Performance Testing
Model tank tests to improve the output of the wave power generator , 10:11062 (TG;GB)
Scale Models
Model tank tests to improve the output of the wave power generator , 10:11062 (TG;GB)
WAVE PROPAGATION
Differential Equations
Electromagnetic inverse problem for dispersive media, 10:11861 (J;US)
WAVEGUIDES
Plasma Waves
Space-charge wave propagation in inhomogeneous waveguides, 10:11535 (J;US)
Space Charge
Space-charge wave propagation in inhomogeneous waveguides, 10:11535 (J;US)
WAZ 16
See NICKEL BASE ALLOYS
WEAK BOSON
See INTERMEDIATE BOSONS
WEAK INTERACTIONS
Composite Models
Massive Yang-Mills - an effective Lagrangian for composite Wsup(+-), Z and new coloured vector bosons, 10:11836 (R;DE)
WEATHERIZATION
Demonstration Programs
Three years after participation: electricity savings due to the BPA Residential Weatherization Pilot Program, 10:11292 (R;US)
WECS
See WIND TURBINES

WEIGHT INDICATORS
Radiometric Gages
Optimal linear filters for radiometric transport belt balances, 10:11561 (R;DE;In German)
WEINBERG-SALAM GAUGE MODEL
Standard model and beyond, 10:11853 (R;US)
WELDED JOINTS
Mechanical Properties
Deformation behavior of a 16-8-2 GTA weld as influenced by its solidification substructure, 10:11370 (J;US)
Physical Radiation Effects
Charpy impact test results of ferritic alloys at fluence to 6 x 10^{23} n/cm , 10:11338 (R;US)
WELDS
See WELDED JOINTS
WELL STIMULATION
Research Programs
95 stimulations in 63 wells, 10:10951 (J;ZZ)
WETLANDS
Water Pollution
Summary of environmental impact assessment studies at the Vienna fly-ash disposal site. Final report, 10:10870 (R;US)
WET-TYPE COOLING TOWERS
See COOLING TOWERS
WILD ANIMALS
Management
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 16, Appendix Q: wildlife management, 10:11206 (R;US)
WILDERNESS AREAS
See NATURE RESERVES
WIND ENERGY CONVERSION SYSTEMS
See WIND TURBINES
WIND GENERATORS
See WIND TURBINES
WIND POWER
Research Programs
Appropriate Technology Small Grants Program. Code case studies, 10:11222 (R;US)
WIND TURBINES
Computerized Control Systems
Investigation of doubly-fed machine in variable speed application, 10:11063 (R;US)
Construction
Darrieus rotor with forward tilting blade speed control, 10:11064 (J;US)
Performance Testing
Investigation of doubly-fed machine in variable speed application, 10:11063 (R;US)
WINDOWS
Attitudes
Windows, skylights, and atria: occupants' visual/subjective comparison, 10:11316 (R;US)
WIPP
Materials Handling
Preliminary requirements for the emplacement and retrieval of defense high-level waste (DHLW) tests in the Waste Isolation Pilot Plant (WIPP), 10:10990 (R;US)
WIRE SPARK CHAMBERS
Computerized Control Systems
Wire chamber radiation detector with discharge control, 10:11571 (P;US)
Design
Wire chamber radiation detector with discharge control, 10:11571 (P;US)
Electric Discharges
Wire chamber radiation detector with discharge control, 10:11571 (P;US)
WOLFRAM
See TUNGSTEN
WOOD
Gasification
Wood power: experiments with a home-made wood gas generator system, 1982-1984, 10:11015 (R;US)
WOOD BURNING APPLIANCES
Environmental Effects
Tennessee Valley Authority/Bonneville Power Administration Indoor Air Quality Study. Volume II, 10:11595 (R;US)
WORKERS
See PERSONNEL

X

XENON
Atom-Atom Collisions
Laser induced fluorescence study of Xe($5p^5$6p, $5p^5$6p', $5p^5$7p, and $5p^5$6d) states in Ne and Ar: Radiative lifetimes and collisional deactivation rate constants, 10:11792 (J;US)
Emission Spectra
Laser induced fluorescence study of Xe($5p^5$6p, $5p^5$6p', $5p^5$7p, and $5p^5$6d) states in Ne and Ar: Radiative lifetimes and collisional deactivation rate constants, 10:11792 (J;US)
Excited States
Laser induced fluorescence study of Xe($5p^5$6p, $5p^5$6p', $5p^5$7p, and $5p^5$6d) states in Ne and Ar: Radiative lifetimes and collisional deactivation rate constants, 10:11792 (J;US)
Fluorescence
Laser induced fluorescence study of Xe($5p^5$6p, $5p^5$6p', $5p^5$7p, and $5p^5$6d) states in Ne and Ar: Radiative lifetimes and collisional deactivation rate constants, 10:11792 (J;US)
Phase Transformations
Observation of a first-order phase transition in Xe/Ta(110) by photoelectron spectroscopy, 10:11360 (J;US)
Sorption
Observation of a first-order phase transition in Xe/Ta(110) by photoelectron spectroscopy, 10:11360 (J;US)
XENON IONS
Electronic Structure
Ab initio effective core potentials for molecular calculations. Potentials for main group elements Na to Bi, 10:11779 (J;US)
X-RAY DETECTION
Photographic Films
Low-energy x-ray response of photographic films. II. Experimental characterization, 10:11575 (J;US)
X-RAY SPECTROSCOPY
Applications of new absolute measurements of x-rays and gamma-rays. Final report, 10:11565 (R;US)
Data Acquisition Systems
Fast data acquisition system for spectroscopy experiments, 10:11562 (R;DE;In German)
XYLOSE
Fermentation
D-xylose fermentation by fusarium oxysporum and other fungi, 10:11023 (R;FI)
X-ZERO RESONANCES
See ETA-958 RESONANCES

Y

Y-12 PLANT
Environmental Impacts
Resource Management Plan for the US Department of Energy Oak Ridge Reservation. Volume 11, Appendix K: site development, 10:11201 (R;US)
YANG-MILLS THEORY
Stochastic Processes
Stochastic variables in N=1 supersymmetric Yang-Mills theory, 10:11852 (R;DE)
YTTERBIUM 161
Energy Levels
Nuclear data sheets for A = 161, 10:11880 (J;US)
Energy-Level Transitions
Nuclear data sheets for A = 161, 10:11880 (J;US)
YTTRIUM
Population Inversion
Demonstration of a soft x-ray amplifier, 10:11499 (J;US)

YTTRIUM ALLOYS
Electric Conductivity
Phase stability and magnetic properties of UAl_2 based pseudobinary spin fluctuation compounds, 10:11341 (R;US)
Magnetic Susceptibility
Phase stability and magnetic properties of UAl_2 based pseudobinary spin fluctuation compounds, 10:11341 (R;US)
Microstructure
Comparison of the microstructures of as-cast and laser surface melted Ti-8Al-4Y, 10:11366 (J;US)
Phase Stability
Phase stability and magnetic properties of UAl_2 based pseudobinary spin fluctuation compounds, 10:11341 (R;US)
Specific Heat
Phase stability and magnetic properties of UAl_2 based pseudobinary spin fluctuation compounds, 10:11341 (R;US)
YTTRIUM ALUMINIUM GARNETS
See ALUMINIUM OXIDES
YUCCA MOUNTAIN
Ground Water
Groundwater chemistry along flow paths between a proposed repository site and the accessible environment, 10:11000 (R;US)

Z

ZEA MAYS
See MAIZE
ZEOLITES
Sorptive Properties
Recovery of ethanol from low concentration solution by adsorption with Silicalite, 10:11021 (R;US)
ZERO POWER REACTORS
See also LR-0 REACTOR
ORNL-PCA REACTOR
Criticality
KENO-V code, 10:11119 (R;US)
ZINC
Biological Effects
Zinc effects on glutathione metabolism relationship to zinc-induced protection from alkylating agents, 10:11700 (J;GB)
Solvent Extraction
Kinetics and mechanism of the interfacial mass transfer of Zn^{2+}, Co^{2+} and Ni^{2+} in the system: bis(2-ethylhexyl)phosphoric acid, n-dodecane - KNO_3, water, 10:11434 (J;US)
ZINC ALLOYS
See also ZINC BASE ALLOYS
Thermal Diffusion
Analysis of concentration profiles for fluxes, diffusion depths, and zero-flux planes in multicomponent diffusion, 10:11368 (J;US)
ZINC BASE ALLOYS
Fracture Properties
Research consortium for x-ray topography on line X-19 at NSLS. Technical progress report, June 1-December 1, 1984 (Zn-Cd), 10:11334 (R;US)
ZIRCALOY
For unspecified Zircaloy alloys.
Corrosion Resistance
Zircaloy cladding corrosion degradation in a Tuff repository: initial experimental plan, 10:10973 (R;US)
ZIRCONATES
Specific compounds should be indexed by coordination of a descriptor of the form (CATION) COMPOUNDS and the above anion descriptor.
Physical Radiation Effects
Self-radiation damage in actinide host phases of nuclear waste forms ($Ca_2Nd_8(SiO_4)_6O_2$; $Gd_2Ti_2O_7$; $CaZrTi_2O_7$), 10:10981 (R;US)
ZIRCONIUM
Phonons
Vibrational frequencies and structural properties of transition metals via total-energy calculations, 10:11339 (R;US)
ZIRCONIUM ALLOYS
Electric Conductivity
Phase stability and magnetic properties of UAl_2 based pseudobinary spin fluctuation compounds, 10:11341 (R;US)
Emission Spectra
Effect of the chemical environment on the L and M heavy-ion-induced x-ray satellite emission spectra, 10:11762 (R;US)
Ion Collisions
Effect of the chemical environment on the L and M heavy-ion-induced x-ray satellite emission spectra, 10:11762 (R;US)
Magnetic Susceptibility
Phase stability and magnetic properties of UAl_2 based pseudobinary spin fluctuation compounds, 10:11341 (R;US)
Phase Stability
Phase stability and magnetic properties of UAl_2 based pseudobinary spin fluctuation compounds, 10:11341 (R;US)
Specific Heat
Phase stability and magnetic properties of UAl_2 based pseudobinary spin fluctuation compounds, 10:11341 (R;US)
X-Ray Spectra
Effect of the chemical environment on the L and M heavy-ion-induced x-ray satellite emission spectra, 10:11762 (R;US)
ZIRCONIUM BROMIDES
Emission Spectra
Effect of the chemical environment on the L and M heavy-ion-induced x-ray satellite emission spectra, 10:11762 (R;US)
Ion Collisions
Effect of the chemical environment on the L and M heavy-ion-induced x-ray satellite emission spectra, 10:11762 (R;US)
X-Ray Spectra
Effect of the chemical environment on the L and M heavy-ion-induced x-ray satellite emission spectra, 10:11762 (R;US)
ZIRCONIUM CARBIDES
Emission Spectra
Effect of the chemical environment on the L and M heavy-ion-induced x-ray satellite emission spectra, 10:11762 (R;US)
Ion Collisions
Effect of the chemical environment on the L and M heavy-ion-induced x-ray satellite emission spectra, 10:11762 (R;US)
X-Ray Spectra
Effect of the chemical environment on the L and M heavy-ion-induced x-ray satellite emission spectra, 10:11762 (R;US)
ZIRCONIUM COMPOUNDS
See also ZIRCONATES
ZIRCONIUM BROMIDES
ZIRCONIUM CARBIDES
ZIRCONIUM NITRIDES
ZIRCONIUM OXIDES
Physical Radiation Effects
Self-radiation damage in actinide host phases of nuclear waste forms ($Ca_2Nd_8(SiO_4)_6O_2$; $Gd_2Ti_2O_7$; $CaZrTi_2O_7$), 10:10981 (R;US)
ZIRCONIUM NITRIDES
Crystal Structure
Electron microscopy investigation of the ZrO_2-ZrN system. II. Tetragonal and monoclinic ZrO_2 precipitation, 10:11399 (J;US)
Domain Structure
Electron microscopy investigation of the ZrO_2-ZrN system. II. Tetragonal and monoclinic ZrO_2 precipitation, 10:11399 (J;US)
Emission Spectra
Effect of the chemical environment on the L and M heavy-ion-induced x-ray satellite emission spectra, 10:11762 (R;US)
Ion Collisions
Effect of the chemical environment on the L and M heavy-ion-induced x-ray satellite emission spectra, 10:11762 (R;US)
X-Ray Spectra
Effect of the chemical environment on the L and M heavy-ion-induced x-ray satellite emission spectra, 10:11762 (R;US)
ZIRCONIUM OXIDES
Crystal Structure
Electron microscopy investigation of the ZrO_2-ZrN system. II. Tetragonal and monoclinic ZrO_2 precipitation, 10:11399 (J;US)

Domain Structure
Electron microscopy investigation of the ZrO_3-ZrN system. II. Tetragonal and monoclinic ZrO_2 precipitation, 10:11399 (J;US)
Emission Spectra
Effect of the chemical environment on the L and M heavy-ion-induced x-ray satellite emission spectra, 10:11762 (R;US)
Ion Collisions
Effect of the chemical environment on the L and M heavy-ion-induced x-ray satellite emission spectra, 10:11762 (R;US)
X-Ray Spectra
Effect of the chemical environment on the L and M heavy-ion-induced x-ray satellite emission spectra, 10:11762 (R;US)

CONTRACT NUMBER INDEX

Numbers assigned to DOE contracts under which documents announced in this publication were prepared are included in this index.

Contract No.	Abstract No.	Report No.
AC01-75ET12536	**Lewin and Associates, Inc., Washington, DC (USA)**	
	10:10940	CONF-8405216—1
AC01-76ET10137	**Texaco, Inc., Montebello, CA (USA). Montebello Research Lab.**	
	10:10830	DOE/ET/10137—T11
AC01-78PE06322	**TERA, Inc., Arlington, VA (USA)**	
	10:11210	DOE/PE/06322—T1
AC01-78RA32012	**TRW Energy Engineering Div., McLean, VA (USA)**	
	10:10954	DOE/RA/32012—T27
AC01-79ET29040	**General Electric Co., Schenectady, NY (USA). Electric Utility Systems Engineering Dept.**	
	10:11065	DOE/ET/29040—1
AC01-79ET29364	**Univ. of California, Berkeley**	
	10:11071	International Journal of Electrical Power and Energy Systems 5 NO. 4. 222-235 (Oct 1983).
AC01-79ET32041	**Pan Heuristics, Marina del Ray, CA (USA)**	
	10:11208	DOE/ET/32041—T1
AC01-80CS10118	**International Business Services, Inc., Washington, DC (USA)**	
	10:11220	DOE/CS/10118—T1-Vol.1
	10:11221	DOE/CS/10118—T1-Vol.2
	10:11222	DOE/CS/10118—T2
AC01-80ET17076	**Pennsylvania Univ., Philadelphia (USA). Energy Center**	
	10:11274	DOE/ET/17076—T1
AC02-76CH00016	**Brookhaven National Lab., Upton, NY (USA)**	
	10:10946	BNL—51830
	10:11004	BNL—35510
	10:11054	BNL—35279
	10:11069	BNL—51818
	10:11138	BNL-NUREG—28186
	10:11139	BNL-NUREG—28738
	10:11160	EPRI-NP—3243-CCM-Vol.2
	10:11325	BNL—35432
	10:11326	BNL—35568
	10:11327	BNL-NUREG—35520
	10:11377	Metallurgia 17 621-624 (1983).
	10:11387	BNL—35564
	10:11481	BNL—35374
	10:11538	BNL—35311
	10:11539	BNL—35486
	10:11540	BNL—35495
	10:11606	Water, Air, and Soil Pollution 18 173-189 (1982).
	10:11607	BNL—51827
	10:11682	American Statistician 37 NO. 4. 442-456 (Nov 1983).
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	10:11759	BNL—35312
	10:11760	BNL—35550
	10:11761	BNL—35573
	10:11881	BNL-NCS—35522
	10:11895	Physics Today 37 NO. 11. 26-35 (Nov 1984).
	10:11924	Mathematics of Computation 43 NO. 168. 433-446 (Oct 1984).
	10:11925	Mathematics of Computation 43 NO. 168. 447-489 (Oct 1984).
	10:12008	BNL—35551
AC02-76CH03000	**Chicago Univ., IL (USA)**	
	10:11737	FNAL/C—84/105
	Fermi National Accelerator Lab., Batavia, IL (USA)	
	10:11738	FNAL/C—84/111-A
	10:11739	FNAL/C—84/117-A
	Northern Illinois Univ., Dekalb (USA)	
	10:11840	FNAL/C—84/87-T
	Wisconsin Univ., Madison (USA). Dept. of Physics	
	10:11841	FNAL/C—84/99-T
	Fermi National Accelerator Lab., Batavia, IL (USA)	
	10:11853	FNAL/C—84/88-T
	10:11889	FNAL/C—84/93-T
AC02-76CH03073	**Princeton Univ., NJ (USA). Plasma Physics Lab.**	
	10:11943	PPPL—2170
	10:11944	PPPL—2171
	10:11945	PPPL—2177
	10:11946	PPPL—2178
AC02-76ER01198	**Univ. of Illinois, Urbana**	
	10:11366	Metallurgical Transactions, [Section] A: Physical Metallurgy and Materials Science 14A 197
	10:11372	Corrosion Science 23 NO. 11. 1153-1162 (1983).
	10:11375	Solid State Communications 47 NO. 11. 935-938 (1983).
	10:11418	Physical Review Letters 54 NO. 1. 71-74 (7 Jan 1985).
	10:11421	Journal of Chemical Physics 81 NO. 12. 6407-6408 (20 Dec 1984).
AC02-76ER02296	**Univ. of Rochester, NY**	
	10:11426	Radiation Effects 75 227-234 (1983).
AC02-76ER03069	**Center for Theoretical Physics, Laboratory for Nuclear Science, Department of Physics, Massachusetts**	
	10:12019	Physical Review Letters 54 NO. 3. 159-162 (21 Jan 1985).
AC02-76ER03077	**Courant Institute of Mathematical Sciences, New York University, 251 Mercer Street, New York, New Yo**	
	10:11955	Physics of Fluids 28 NO. 1. 287-293 (Jan 1985).
AC02-76ER04075	**Case Western Reserve Univ., Cleveland, OH (USA). Dept. of Metallurgy and Materials Science**	
	10:11392	DOE/ER/04075—T3
AC02-76ET11304	**Courtesy Associates, Inc., Washington, DC (USA)**	
	10:11235	CONF-831104—Summs.(1983).
AC02-76EV02217	**Illinois Inst. of Tech., Chicago (USA). Dept. of Physics**	
	10:11686	DOE/EV/02217—51
AC02-76EV03490	**Univ. of Rochester School of Medicine, NY**	
	10:11678	Radiation Research 100 NO. 2. 273-281 (Nov 1984).

Contract No.	Abstract No.	Report No.
AC02-77CH00178	Florida Solar Energy Center, Cape Canaveral (USA)	
	10:11050	FSEC-CR—108-84
AC02-77ER04451	Univ. of Utah, Salt Lake City	
	10:11180	Journal of Materials Science 17 753-759 (1982).
	10:11181	Journal of Materials Science 16 1142-1150 (1981).
AC02-77ER04461	Massachusetts Inst. of Tech., Cambridge (USA)	
	10:11332	CONF-8404219—1
AC02-78ER04908	The James Franck Institute and Department of Chemistry, The University of Chicago, Chicago, Illinois	
	10:11797	Physical Review [Section] A: General Physics 30 NO. 5. 2264-2273 (Nov 1984).
	10:11798	Physical Review [Section] A: General Physics 30 NO. 5. 2390-2398 (Nov 1984).
AC02-78ET51013	Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center	
	10:11930	DOE/ET/51013—134
	10:11976	DOE/ET/51013—122
AC02-78EV04706	Manomet Bird Observatory, MA	
	10:11628	Oceanus 26 NO. 1. 11-17 (Spr 1983).
AC02-78EV04733	Columbia Univ., New York, NY	
	10:11472	Radiation Research 100 NO. 2. 245-256 (Nov 1984).
	10:11677	Radiation Research 100 NO. 2. 213-221 (Nov 1984).
AC02-78EV04776	Univ. of Colorado, Boulder	
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AC02-79ER10366	Colorado Univ., Boulder (USA)	
	10:11468	DOE/ER/10366—5
AC02-79ER10421	Univ. of Utah, Salt Lake City	
	10:11072	IEEE (Institute of Electrical and Electronics Engineers) Transactions on Electrical Insula
AC02-79ER10431	Wisconsin Univ., Milwaukee (USA)	
	10:11764	DOE/ER/10431—1
AC02-79ER10453	Rensselaer Polytechnic Inst., Troy, NY (USA)	
	10:11408	DOE/ER/10453—04
AC02-79EV10237	Brigham Young Univ., Provo, UT (USA). Dept. of Chemistry	
	10:10850	DOE/EV/10237—T1
	10:11702	Mutation Research 117 31-40 (1983).
AC02-80ER10575	Chicago Univ., IL (USA). Enrico Fermi Inst.	
	10:11057	DOE/ER/10575—T2
AC02-80ER10622	Kent State Univ., OH	
	10:11435	Analytical Chemistry 54 NO. 2. 326-328 (Feb 1982).
AC02-80ER10677	Kansas State University, Department of Nuclear Engineering & Physics, Manhattan, Kansas 66506	
	10:11807	Applied Optics 23 NO. 22. 4149-4154 (15 Nov 1984).
AC02-80ER10699	State Univ. of New York, Stony Brook (USA)	
	10:11543	CONF-8403130—7
	10:11819	DOE/ER/10699—T4
AC02-80ER10709	Univ. of Southern California, Los Angeles	
	10:12023	Journal of Mathematical Analysis and Applications 91 NO. 1. 22-61 (Jan 1983).
AC02-80ET17089	Courtesy Associates, Inc., Washington, DC (USA)	
	10:11246	CONF-831104—Summs.(1983).
	10:11255	CONF-831104—Summs.(1983).
AC02-81ER10811	Brown Univ., Providence, RI	
	10:11465	Berichte der Bunsengesellschaft fuer Physikalische Chemie 87 600-602 (1983).

Contract No.	Abstract No.	Report No.
AC02-81ER10814	Purdue Univ., West Lafayette, IN	
	10:11368	Metallurgical Transactions, [Section] A: Physical Metallurgy and Materials Science 14A 185
AC02-81ER10880	New York State Dept. of Health, Albany	
	10:11662	4 451-458 (1983).
AC02-81ER10907	Dartmouth Coll., Hanover, NH	
	10:11369	Metallurgical Transactions, [Section] A: Physical Metallurgy and Materials Science 14A 152
AC02-81ER10941	Michigan Technological Univ., Houghton	
	10:11380	Scripta Metallurgica 17 NO. 12. 1415-1418 (1983).
AC02-81ER10996	Santa Barbara Research Center, Goleta, California 93117	
	10:12020	Mathematics of Computation 42 NO. 166. 535-547 (Apr 1984).
AC02-81ER40025	Colorado Univ., Boulder (USA)	
	10:11544	DOE/ER/40025—27
	10:11560	DOE/ER/40025—T1
	Colorado Univ., Boulder (USA). Dept. of Physics	
	10:11820	DOE/ER/40025—17
	10:11821	DOE/ER/40025—19
	10:11827	Physical Review Letters 54 NO. 2. 95-98 (14 Jan 1985).
	10:11834	CONF-8304153—2
	Colorado Univ., Boulder (USA)	
	10:11851	DOE/ER/40025—31
	Los Alamos National Lab., NM (USA)	
	10:11906	DOE/ER/40025—T2
AC02-81ER40033	Rockefeller Univ., New York (USA)	
	10:11822	DOE/ER/40033—70
	Rockefeller Univ., New York (USA). Dept. of Physics	
	10:11839	DOE/ER/40033—55
AC02-81EV10665	Columbia Univ., Palisades, NY (USA). Lamont-Doherty Geological Observatory	
	10:11586	DOE/EV/10665—5
AC02-81RA50292	Westinghouse Electric Corp., Pittsburgh, PA (USA)	
	10:11063	DOE/RA/50292—T2
AC02-82ER12054	XDATA Corp., Indianapolis, IN (USA)	
	10:11483	DOE/ER/12054—T1
AC02-82ER13012	St. John Fisher Coll., Rochester, NY	
	10:11503	Physics Letters 99A NO. 4. 150-155 (28 Nov 1983).
AC02-82ER13019	Massachusetts Inst. of Tech., Cambridge (USA)	
	10:11025	DOE/ER/13019—2
AC02-82ER40068	Physics Department, Iowa State University, Ames, Iowa 50011	
	10:11894	Physical Review [Section] C: Nuclear Physics 31 NO. 1. 207-211 (Jan 1985).
AC02-82ER60087	Univ. of Colorado School of Medicine, Denver	
	10:10939	JOM, Journal of Occupational Medicine 26 NO. 9. 662-670 (Sep 1984).
AC02-83CH10093	Solar Energy Research Inst., Golden, CO (USA)	
	10:11035	SERI/CP—211-2507
	North Carolina State Univ., Raleigh (USA). Dept. of Physics	
	10:11036	SERI/STR—211-2475
	Xerox Palo Alto Research Center, CA (USA)	
	10:11037	SERI/STR—211-2557
	State Univ. of New York, Buffalo (USA)	
	10:11038	SERI/STR—211-2558
	Solar Energy Research Inst., Golden, CO (USA)	
	10:11060	SERI/SP—271-2470

Contract No.	Abstract No.	Report No.
AC02-83CH10139	**RE/SPEC, Inc., Rapid City, SD (USA)**	
	10:11723	BMI/OCRD—7
AC02-83CH10140	**RE/SPEC, Inc., Rapid City, SD (USA)**	
	10:10967	BMI/ONWI—529
	Stone and Webster Engineering Corp., New York (USA)	
	10:10997	BMI/ONWI—524
AC02-83ER13041	**City Coll., New York (USA). Dept. of Physics**	
	10:11765	DOE/ER/13041—T2
AC02-83ER13063	**Chemical Dynamics Laboratory, University of Minnesota, Minneapolis, Minnesota 55455**	
	10:11790	Journal of Chemical Physics 81 NO. 12. 5577-5585 (15 Dec 1984).
AC02-83ER13116	**Department of Physics, Western Michigan University, Kalamazoo, Michigan 49008**	
	10:11781	Physical Review Letters 53 NO. 27. 2551-2554 (31 Dec 1984).
AC02-83FE60406	**Fuel and Mineral Resources, Inc., Reston, VA (USA)**	
	10:11627	DOE/FE/60406—T1-Vol.4
AC02-84ER13167	**Brown Univ., Providence, RI (USA)**	
	10:11802	DOE/ER/13167—2
AC03-76SF00098	**Courtesy Associates, Inc., Washington, DC (USA)**	
	10:11264	CONF-831104—Summs.(1983).
	Lawrence Berkeley Lab., CA (USA)	
	10:11289	LBL—16220
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Contract No.	*Abstract No.*	*Report No.*
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	10:11673	DOE/EV/10564—T1
FC01-83FE60149	**National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)**	
	10:10938	NIPER—23-Vol.1
	10:11321	NIPER—23-Vol.3
FC02-80ET20645	**Honeywell, Inc., Roseville, MN (USA). Technology Strategy Center**	
	10:11053	DOE/ET/20645—1
FC20-78LC10747	**VTN Consolidated, Inc., Irvine, CA (USA)**	
	10:10955	DOE/LC/10747—T10
FC21-82MC19363	**Curtiss-Wright Corp., Wood-Ridge, NJ (USA). Power Systems Div.**	
	10:11524	DOE/MC/19363—1713
FC22-83FE60339	**Southern Illinois Univ., Carbondale (USA). Coal Extraction and Utilization Research Center**	
	10:10831	DOE/FE/60339—T7
FG01-79IR10297	**Stanford Univ., CA (USA). Energy Modeling Forum**	
	10:10953	DOE/IR/10297—T2
FG01-80PE70290		
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FG01-82CE15101	**Techmet Corp., Greenwich, CT (USA)**	
	10:11308	DOE/CE/15101—T1
FG02-80CS84001	**Univ. of Arizona, Tucson**	
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	10:11476	DOE/ER/13224—T1
FG02-84ER13237	**Missouri Univ., St. Louis (USA)**	
	10:11766	DOE/ER/13237—T1
FG02-84ER40146	**Syracuse Univ., NY (USA). Dept. of Physics**	
	10:11545	DOE/ER/40146—1
FG02-84ER45096	**Wisconsin Univ., Madison (USA)**	
	10:11350	SAND—84-1292C
FG02-84ER45098	**State Univ. of New York, Stony Brook (USA). Dept. of Materials Science and Engineering**	
	10:11334	DOE/ER/45098—5
FG02-84ER60218	**Univ. of Illinois, Urbana**	
	10:11660	Journal of Nuclear Medicine 25 NO. 11. 1212-1221 (Nov 1984).
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FG05-81ER40011		
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	10:11887	DOE/ER/40145—1
FG05-84ER40154	**Kentucky Univ., Lexington (USA)**	
	10:11888	DOE/ER/40154—1
FG06-79R000040	**Vowell (R. Charles), Unalaska, AK (USA)**	
	10:11014	DOE/R0/00040—T1
FG06-81R001261	**Barkas (Walter II), Vaughn, WA (USA)**	
	10:11015	DOE/R0/01261—T1
FG06-81R001326	**Meyers (Nathan), Corvallis, OR (USA)**	
	10:11669	DOE/R0/01326—T1
FG22-82PC52274	**Southern Illinois Univ., Carbondale (USA). Coal Extraction and Utilization Research Center**	
	10:10894	DOE/PC/52274—T5
FG22-83PC60806	**Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Dept. of Mining and Minerals Engineering**	
	10:10911	DOE/PC/60806—T2
FG22-83PC60812	**Utah Univ., Salt Lake City (USA). Dept. of Fuels Engineering**	
	10:11458	DOE/PC/60812—T3
	10:11459	DOE/PC/60812—T4
	10:11460	DOE/PC/60812—T5
FG22-84PC70775	**California Inst. of Tech., Pasadena (USA)**	
	10:10925	DOE/PC/70775—1
FG44-80R410164	**Eckerd Coll., St. Petersburg, FL (USA)**	
	10:11287	DOE/R4/10164—T1
FG44-80R410228	**Harris (Thomas D.), Cleveland, AL (USA)**	
	10:11016	DOE/R4/10228—T1
FG44-80R410300	**Humm (Harold J.), St. Petersburg, FL (USA)**	
	10:11017	DOE/R4/10300—T1
FG44-81R410452	**Propst (Ronald), Winston-Salem, NC (USA)**	
	10:11288	DOE/R4/10452—T1
FG44-81R410460	**Montgomery (John A., Jr.), Columbia, SC (USA)**	
	10:11020	DOE/R4/10460—T1
W-31-109-ENG-38	**Argonne National Lab., IL (USA)**	
	10:10998	CONF-841245—1
	10:11010	ANL/CNSV—46
	10:11011	ANL/CNSV-TM—124
	10:11129	CONF-8410173—6
	10:11133	CONF-8410173—9
	10:11134	CONF-8410173—11
	10:11159	CONF-8410173—10
	10:11179	CONF-831086—14
	10:11184	CONF-841136—3
	10:11219	CONF-841136—4
	10:11226	CONF-831104—3
	10:11318	ANL/OEPM—83-5
	Purdue Univ., Lafayette, IN (USA). School of Materials Engineering	
	10:11333	CONF-8409179—5
	10:11383	Diffusion and Defect Data 32 1-8 (1983).
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	10:11482	CONF-830609—74
	Argonne National Lab., IL (USA)	
	10:11507	CONF-850712—3
	10:11529	ANL-HEP-CP—84-74
	10:11536	ANL/HEP-CP—84-81
	10:11537	ANL-HEP-CP—84-86
	10:11542	CONF-841117—33
	10:11558	ANL-HEP-CP—84-77
	10:11588	CONF-8410165—3
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	10:11672	CONF-8410161—3
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	10:11813	ANL/HEP-CP—84-87
	10:11832	ANL-HEP-CP—83-45
	10:11833	ANL-HEP-CP—84-76
	Argonne National Lab., Idaho Falls, ID (USA)	
	10:11862	CONF-8411118—8
	Argonne National Lab., IL (USA)	
	10:11865	ANL-HEP-CP—84-82
	Argonne National Lab., Idaho Falls, ID (USA)	
	10:11882	CONF-8411118—10
W-7405-ENG-26	**Oak Ridge National Lab., TN**	
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Contract No.	*Abstract No.*	*Report No.*
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W-7405-ENG-36		**Los Alamos National Lab., NM (USA)**
	10:11000	LA—10188-MS
	10:11006	LA—10135-C
	10:11341	LA—10199-T
	10:11342	LA-UR—84-3810
	10:11430	LA—9879-MS
	10:11485	LA—10231-SOP
	10:11740	LA-UR—84-3566
	10:11768	LA-UR—84-3805
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	10:11879	LA-UR—84-3812
	10:11899	LA—10049-M-Rev.1
	10:12013	LA—10255-T
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	10:12014	LA-UR—76-2656
W-7405-ENG-48		**Lawrence Livermore National Lab., CA (USA)**
	10:10992	UCID—20301
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	10:11498	Physical Review Letters 54 NO. 2. 106-109 (14 Jan 1985).
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	10:11597	UCRL—91446
	10:11598	UCRL—91830
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	10:11676	UCRL—15644
	10:11746	(1984).
	10:11795	Physical Review [Section] A: General Physics 30 NO. 5. 2381-2389 (Nov 1984).
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	10:11806	Journal of Computational Physics 56 NO. 3. 530-536 (Dec 1984).

Contract No.	Abstract No.	Report No.
	10:11885	Physical Review Letters 53 NO. 25. 2382-2385 (17 Dec 1984).
	Lawrence Livermore National Lab., CA (USA)	
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	California Univ., Santa Barbara (USA). Dept. of Electrical and Computer Engineering	
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	Lawrence Livermore National Lab., CA (USA)	
	10:11983	UCID—20141
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	10:12005	UCRL—52000-84-12
	10:12017	UCID—30189-Rev.1
	Colorado Univ., Denver (USA). Dept. of Electrical Engineering	
	10:12018	UCRL—15645
	10:12021	Mathematics of Computation 42 NO. 166. 549-565 (Apr 1984).
W-7405-ENG-82	**Ames Lab., IA (USA)**	
	10:10913	IS-T—1091
	10:10974	IS-T—1120
	10:11021	IS-T—1171
	10:11339	IS-T—1064
	10:11409	IS-T—1163
	10:11428	IS-T—1169
	10:11444	IS-T—1138
	10:11461	IS-T—1131
	10:11462	IS-T—1167
	10:11548	IS-T—1132
	10:11641	IS-T—1184
	10:11642	Science (Washington, D.C.) 223 289-291 (20 Jan 1984).
	10:11791	Journal of Chemical Physics 81 NO. 12. 5672-5691 (15 Dec 1984).
	10:11823	IS-T—1145
	10:11861	Journal of Mathematical Physics (New York) 26 NO. 2. 317-325 (Feb 1985).
	10:11916	Physical Review [Section] B: Condensed Matter 31 NO. 3. 1318-1323 (1 Feb 1985).

REPORT NUMBER INDEX

The numbers assigned to reports cited in this publication appear in the first column of the index. Cross reference information and/or availability are included as appropriate. Abbreviations used in the availability column are elaborated at the end of the index. To expedite the filling of orders for reports from NTIS and OSTI, a file number in the form, DE82000001 or TI82000001, appears in column 3. File numbers with DE prefixes may be used in ordering from both NTIS and OSTI. Numbers with TI prefixes are valid at OSTI only. Requesters are urged to use this file number where provided. In column 4, one or more DOE distribution categories are indicated, e.g., STD-10, MN-25. STD indicates distribution was made in full-size copy; MN indicates microcopy distribution; ND indicates no distribution was made. These category numbers are included to assist DOE librarians in responding to requests for reports in their collections. The UC (Unclassified Distribution Categories) are defined in DOE/TIC-4500, available from OSTI. The citation numbers are given in column 5. NOTE: DOE attempts to disseminate its information as broadly as possible. Even though a report may contain some degree of illegibility, it is believed that the report may still make a contribution. The presence of a 1, 2, or 3 following NTIS in the availability column denotes the extent to which a report may be illegible and the form in which it is available: 1 = 5 to 8% illegibility, available PC and MF; 2 = 9 to 12% illegibility, available MF only; 3 = 13% or more illegibility, available PC only. For the users of DOE/RECON, report ordering may be accomplished more expeditiously via the on-line system. Employees of DOE or DOE contractors are urged to order from the Office of Scientific and Technical Information (OSTI); all others should order from the National Technical Information Service (NTIS). Procedures for on-line ordering are detailed in the DOE/RECON User's Manual (DOE/TIC-4586).

Report Number	*Availability Source*	*File Number*	*Distribution Category*	*Abstract Number*
ACIRL-PR-				
84-11	Australian Coal Industry Research Labs. Ltd., North Ryde			10:10893
AD-A-				
142076	US Army Armament Research and Development Center, Dover, NJ	TI85900221	MN -38	10:11480
142700	*See* N-84-31049			10:12030
143216/ 0	NTIS, PC A02/MF A01			10:11493
143225/ 1	NTIS, PC A03/MF A01			10:11896
143233/ 5	NTIS, PC A09/MF A01			10:11516
143289/ 7	NTIS, PC A07/MF A01			10:11528
143295/ 4	NTIS, PC A02/MF A01			10:11494
143350/ 7	NTIS, PC A03/MF A01			10:11897
143391/ 1	NTIS, PC A03/MF A01			10:11747
143449/ 7	NTIS, PC A04/MF A01			10:11495
143469/ 5	NTIS, PC A02/MF A01			10:11324
143530/ 4	NTIS, PC A03/MF A01			10:11320
143538/ 7	NTIS, PC A03/MF A01			10:11496
143556/ 9	NTIS, PC A03/MF A01			10:11912
146786/ 9/ XAB	NTIS, PC A02/MF A01			10:12007
147035/ 0/ XAB	NTIS, PC A02/MF A01			10:11438
147435/ 2/ XAB	NTIS, PC A03/MF A01			10:11733
147561/ 5/ XAB	NTIS, PC A03/MF A01			10:11734
AD-P-				
003642/ 6	NTIS, PC A02/MF A01			10:11121
AFLRL-				
175	*See* AD-A-143530/4			10:11320
ANL/CNSV-				
46	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99: DE85006492	STD -98F	10:11010
ANL/CNSV-TM-				
124	NTIS, PC A06/MF A01 (GPO Dep.)	E 1.99: DE85004826	MN -95e	10:11011
ANL-HEP-CP-				
83-45	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85005030	MN -34C	10:11832
84-74	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85005026	MN -28	10:11529
84-76	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE85004818	MN -34D	10:11833
84-77	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85004817	MN -34C	10:11558
84-81	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85005062	MN -28	10:11536
84-82	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85005028	MN -34C	10:11865
84-86	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85004063	MN -28	10:11537
84-87	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85004065	MN -34D	10:11813
ANL/OEPM-				
83-5	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99: DE85004940	STD -94ca	10:11318
B-				
8467321	*See* N-84-30949			10:11826
BMI/OCRD-				
7	NTIS, PC A13/MF A01; 1 (GPO Dep.)	E 1.99: DE85006261	STD -70	10:11723
BMI/ONWI-				
524	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99: DE85005639	STD -70	10:10997
529	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99: DE85006318	STD -70	10:10967
BNL-				
35279	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85004160	MN -59B	10:11054
35311	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85004059	MN -28	10:11538
35312	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85005128	MN -28	10:11759

Report Number	*Availability Source*	*File Number*		*Distribution Category*	*Abstract Number*
35374	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85005121	MN -38	10:11481
35432	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85005207	MN -25	10:11325
35486	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004189	MN -28	10:11539
35495	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85005131	MN -28	10:11540
35510	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004704	MN -16	10:11004
35550	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004700	MN -34A	10:11760
35551	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85005124	MN -32	10:12008
35564	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85005137	MN -25	10:11387
35568	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004702	MN -25	10:11326
35573	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85005133	MN -25	10:11761
35728	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85005208	MN -34B	10:11735
51818	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE85005637	STD -97a	10:11069
51827	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE85005651	STD -11	10:11607
51830	NTIS, PC A04/MF A01		DE85005634	STD -98C	10:10946
BNL-NCS-					
35522	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85004712	MN -34C	10:11881
BNL-NUREG-					
28186	NTIS, PC A02/MF A01 - GPO		TI85004835	MN -78	10:11138
28738	NTIS, PC A02/MF A01 - GPO		TI85004736	MN -78	10:11139
35520	NTIS, PC A02/MF A01 - GPO		TI85005129	MN -25	10:11327
BONN-HE-					
84-9	NTIS (US Sales Only), PC A02/MF A01		DE85750274	MN -34D	10:11852
84-11	NTIS (US Sales Only), PC A02/MF A01		DE85750275	MN -28	10:11556
84-15	NTIS (US Sales Only), PC A03/MF A01		DE85750294	MN -34D	10:11850
84-17	NTIS (US Sales Only), PC A03/MF A01		DE85750293	MN -34D	10:11917
CALT-					
68-1197	*See* ANL-HEP-CP-84-76	E 1.99:	DE85004818	MN -34D	10:11833
CE-Trans-					
7730	NTIS (US Sales Only), PC A02/MF A01; 1		DE85900181	MN -41	10:11713
7857	NTIS (US Sales Only), PC A03/MF A01; 1		DE85900122	MN -90i	10:10876
CONF-7704133-	(Comite Francais d'Electrothermie symposium, Versailles, France, 21-22 Apr 1977)				
5-Trans.	*See* OA-tr-1859		DE85900530	MN -95f	10:11312
CONF-7802105-	(4. National Earthquake Hazards Reduction Program conference on use of volunteers, Menlo Park, CA, USA, 2-3 Feb 1978)				
	See USGS-OFR-78-336		TI83902524	MN -11	10:11715
CONF-7810298-	(AIM conference on induction heating and melting, Liege, Belgium, 2-6 Oct 1978)				
1-Trans.	*See* OA-tr-2430		DE85900547	MN -95f	10:11313
CONF-800202-	(SAE automotive engineering congress and exposition, Detroit, MI, USA, 25-29 Feb 1980)				
	No. 800111, 1-5(1980)				10:11302
CONF-800747-	(Review group conference on advanced instrumentation for reactor safety research, Oak Ridge, TN, USA, 29-31 Jul 1980)				
2	NTIS, PC A02/MF A01		TI85004724	MN -78	10:11122
CONF-801045-	(DOE statistical symposium, Berkeley, CA, USA, 29-31 Oct 1980)				
2	NTIS, PC A03/MF A01		TI85004730	MN -78	10:11076
CONF-801091-	(International symposium on fuel rod simulators-development and application, Gatlinburg, TN, USA, 22-24 Oct 1980)				
1	NTIS, PC A03/MF A01		TI85004763	MN -78	10:11140
3	NTIS, PC A03/MF A01 - GPO		TI85004761	MN -78	10:11141
10	NTIS, PC A02/MF A01		TI85004723	MN -78	10:11142
CONF-8010156-	(Chinese-American engineering and management institute symposium on nuclear power, New York, NY, USA, 12 Oct 1980)				
1	*See* BNL-NUREG-28738		TI85004736	MN -78	10:11139
CONF-8010378-	(Parallel processing for power system planning and operations seminar, Dallas, TX, USA, 20-23 Oct 1980)				
	See EPRI-EL-3775		TI85920130	ND -97	10:11066
CONF-801107-	(ANS international conference, Washington, DC, USA, 17-21 Nov 1980)				
26	NTIS, PC A02/MF A01		TI85004751	MN -78	10:11132
38	NTIS, PC A02/MF A01		TI85004518	MN -78	10:11143
CONF-801163-	(IEEE ultrasonics symposium, Boston, MA, USA, 5-7 Nov 1980)				
1	NTIS, PC A02/MF A01; 1		TI85004517	MN -78	10:11090
CONF-810113-	(Simulation methods for nuclear power systems conference, Tucson, AZ, USA, 1 Jan 1981)				
3	NTIS, PC A02; 3		DE85004752	MN -78	10:11144
4	*See* BNL-NUREG-28186		TI85004835	MN -78	10:11138
CONF-810120-	(Workshop on the impact of hydrogen on water reactor safety, Albuquerque, NM, USA, 26-28 Jan 1981)				
7	NTIS, PC A02/MF A01		TI85004753	MN -78	10:11145
CONF-810134-	(Orbis scientiae: gauge theories, massive neutrinos, and proton decay, Ft. Lauderdale, FL, USA, 19-22 Jan 1981)				
	Plenum Publishing Corp., 233 Spring Street, New York, NY 10013		TI85001578	ND -34	10:11812

Report Number	Availability Source	File Number	Distribution Category	Abstract Number
CONF-810209-	(9. international pipeline technology conference, Houston, TX, USA, 24-26 Feb 1981)			
	87-108(1981)			10:11178
CONF-810406-	(27. international instrumentation symposium, Indianapolis, IN, USA, 27-30 Apr 1981)			
8	NTIS, PC A02/MF A01	TI85004531	MN -78	10:11146
9	NTIS, PC A02/MF A01	TI85004754	MN -78	10:11147
10	NTIS, PC A02/MF A01	TI85004539	MN -78	10:11148
CONF-810621-	(Symposium on fluid mechanics of combustion systems, Boulder, CO, USA, 22-24 Jun 1981)			
4	NTIS, PC A02/MF A01	TI85004520	MN -78	10:11123
CONF-810801-	(6. international conference on structural mechanics in reactor technology, Paris, France, 17-21 Aug 1981)			
54	NTIS, PC A02/MF A01	TI85004519	MN -78	10:11149
CONF-810803-	(Topical meeting on reactor safety aspects of fuel behavior, Sun Valley, ID, USA, 2-6 Aug 1981)			
21	NTIS, PC A02/MF A01	TI85004741	MN -78	10:11150
22	NTIS, PC A02/MF A01	TI85004745	MN -78	10:11151
23	NTIS, PC A02/MF A01	TI85004746	MN -78	10:11152
CONF-810804-	(National heat transfer conference, Milwaukee, WI, USA, 2-5 Aug 1981)			
18	NTIS, PC A02/MF A01	TI85004750	MN -78	10:11153
21	NTIS, PC A02/MF A01 - GPO	TI85004744	MN -78	10:11154
CONF-811012-	(IEEE symposium on nuclear science, San Francisco, CA, USA, 21-23 Oct 1981)			
62-Rev.	*See* LBL-14145-Rev.	E 1.99: DE85004895	MN -37	10:11563
CONF-811042-	(9. water reactor safety research information meeting, Washington, DC, USA, 26-28 Oct 1981)			
7	NTIS, PC A02/MF A01	TI85004510	MN -78	10:11091
CONF-8110246-	(19. international conference of research institutes in safety in mines, Katowice, Poland, 5-13 Oct 1981)			
4	*See* HSE-Trans-10002	DE85900531	MN -88	10:10905
CONF-8203198-	(Conference on photobiologic, toxicologic, and pharmacologic aspects of psoralens, Research Triangle Park, NC, USA, 1-3 Mar 1982)			
1	*See* DOE/EV/02217-51	E 1.99: DE85004289	MN -48	10:11686
CONF-820615-	(26. American Association of Cost Engineers annual meeting, Houston, TX, USA, 27-30 Jun 1982)			
3	*See* K/D-5313	E 1.99: DE85004048	MN -2	10:12004
CONF-8210321-	(Workshop on pitting in steam generator tubing, Pittsburgh, PA, USA, 28-29 Oct 1982)			
Summs.	*See* EPRI-NP-3574-SR	TI85920098	ND -78	10:11095
CONF-821170-	(Conference on laser induced damage in optical materials, Boulder, CO, USA, 15-18 Nov 1982)			
	Opt. Eng., 22: No. 4, 450-455(Jul-Aug 1983)			10:11423
CONF-830419-	(16. rare earth research conference, Tallahassee, FL, USA, 18-21 Apr 1983)			
	J. Less-Common Met., 93: 293-300(1983)			10:11378
CONF-8304153-	(11. international winter meeting on fundamental physics, Toledo, Spain, 11-16 Apr 1983)			
2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85004870	MN -34D	10:11834
CONF-830539-	(International meeting for radionuclide metrology - alpha particle spectrometry and low level measurement, Harwell, UK, 10-13 May 1983)			
	Nucl. Instrum. Methods Phys. Res., Sect. A, 223: No. 2/3, 349-355(15 Jun 1984)			10:11431
	Nucl. Instrum. Methods Phys. Res., Sect. A, 223: No. 2/3, 528-530(15 Jun 1984)			10:11432
	Nucl. Instrum. Methods Phys. Res., Sect. A, 223: No. 2/3, 372-376(15 Jun 1984)			10:11572
	Nucl. Instrum. Methods Phys. Res., Sect. A, 223: No. 2/3, 303-311(15 Jun 1984)			10:11864
CONF-830609-	(ANS annual meeting, Detroit, MI, USA, 12-17 Jun 1983)			
74	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85005018	MN -46	10:11482
CONF-830782-	(11. L. H. Gray conference on cellular repair of radiation damage - mechanisms and modifying agents, Glasgow, UK, 18-22 Jul 1983)			
5	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85005036	MN -48	10:11671
CONF-830797-	(Workshop on high energy transients in astrophysics, Santa Cruz, CA, USA, 11-22 Jul 1983)			
	American Institute of Physics, 335 E. 45th Street, New York, NY 10017	TI84013699	ND -34B	10:11746
CONF-830803-	(3. international conference on numerical methods in laminar and turbulent flow, Seattle, WA, USA, 8-11 Aug 1983)			
11	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85004437	MN -38	10:11506
CONF-830805-	(7. international conference on structural mechanics in reactor technology, Chicago, IL, USA, 22-26 Aug 1983)			
	Nucl. Eng. Des., 79: No. 3, 301-307(Jun 1984)			10:11128
CONF-830811-	(Conference on quantitative NDE, Santa Cruz, CA, USA, 7-12 Aug 1983)			
20	*See* RFP-3548	E 1.99: DE85004098	MN -38	10:11513

Report Number	*Availability Source*	*File Number*	*Distribution Category*	*Abstract Number*
CONF-830867-	(7. international seminar on computational aspects of the finite element method, Chicago, IL, USA, 29-30 Aug 1983)			
	Nucl. Eng. Des., 79: No. 3, 301-307(Jun 1984)			10:11128
CONF-8308103-	(ASCE hydraulics division specialty conference, Cambridge, MA, USA, 8-12 Aug 1983)			
2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85003893	MN -38	10:11508
CONF-8308163-	(Annual Illuminating Engineering Society conference, Los Angeles, CA, USA, 8-11 Aug 1983)			
2	*See* LBL-16220	E 1.99: DE85004655	MN -95c	10:11289
CONF-830942-	(3. topical meeting on fusion reactor materials, Albuquerque, NM, USA, 19-23 Sep 1983)			
	J. Nucl. Mater., 122: No. 1-3, 14-16(May 1984)			10:11422
CONF-8309167-	(Annual meeting of Association for Aerosol Research, Munich, F.R. Germany, 13-16 Sep 1983)			
	J. Aerosol Sci., 15: No. 3, 347-349(1984)			10:11131
CONF-8309187-	(CSNI leak-before-break conference, Monterey, CA, USA, 1-2 Sep 1983)			
	See NUREG/CP-0051	TI84901888	MN -80	10:11167
CONF-8309196-	(Meeting of the Division of Particles and Fields, Blacksburg, VA, USA, 15-17 Sep 1983)			
	American Institute of Physics, 335 E. 45th Street, New York, NY 10017	TI84008600	ND -34D	10:11811
CONF-8309282-	(20. meeting of the Gesellschaft fuer Paediatrische Radiologie, Stuttgart, F.R. Germany, 30 Sep-1 Oct 1983)			
Absts.	*See* INIS-mf-8892	DE85780115	MN -48	10:11658
CONF-831086-	(Electrochemical Society fall meeting, Washington, DC, USA, 9-14 Oct 1983)			
14	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85005039	MN -94cc	10:11179
CONF-8310227-	(Monopole '83 conference, Ann Arbor, MI, USA, 6-9 Oct 1983)			
9	*See* ANL-HEP-CP-83-45	E 1.99: DE85005030	MN -34C	10:11832
10	*See* FNAL/C-84/111-A	E 1.99: DE85003922	MN -34B	10:11738
CONF-8310345-	(4. international training course on implementation of state sysytems of accounting for the control of nuclear materials (SSAC), Santa Fe, NM, USA, 17 Oct-4 Nov 1983)			
	See LA-10135-C	E 1.99: DE85004636	STD -15	10:11006
CONF-831104-	(National fuel cell seminar, Orlando, FL, USA, 13-16 Nov 1983)			
3	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85005050	MN -93	10:11226
Summs.	NTIS, PC A09/MF A01; 1 (GPO Dep.)	E 1.99: DE84015345	MN -93	10:11227
CONF-8311208-	(2. seminar on countermeasures for pipe cracking in BWRs, Palo Alto, CA, USA, 15-18 Nov 1983)			
Vol.2	*See* EPRI-NP-3684-SR-Vol.2	TI85920099	ND -78	10:11077
CONF-831277-	(1. international conference on the physics of the 21st century, Tuscon, AZ, USA, 5-8 Dec 1983)			
2	*See* ANL-HEP-CP-84-74	E 1.99: DE85005026	MN -28	10:11529
CONF-840295-	(ANS/ENS topical meeting on probabilistic safety methods and applications, San Francisco, CA, USA, 24-28 Feb 1984)			
3	*See* SAND-84-1811C	E 1.99: TI85003532	MN -80	10:11169
CONF-840311-	(4. international symposium on heating in toroidal plasmas, Rome, Italy, 21-28 Mar 1984)			
17	*See* DOE/ET/51013-122	E 1.99: DE85004914	MN -21	10:11976
CONF-840326-	(Seminar on practical experience in the application of quality control in water reactor fuel fabrication, Karlsruhe, F.R. Germany, 12-16 Mar 1984)			
	See KFK-3777	DE85750267	MN -78	10:11099
CONF-8403108-	(SUGI conference, Hollywood, FL, USA, 18-21 Mar 1984)			
2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE84008569	MN -32	10:11927
CONF-8403113-	(Europhysics conference, Erice, Italy, 4-11 Mar 1984)			
8	*See* DOE/ER/40025-17	E 1.99: DE85004840	MN -34D	10:11820
CONF-8403130-	(4. topical workshop on proton antiproton collider physics, Bern, Switzerland, 5-8 Mar 1984)			
6	*See* DESY-84-056	DE85750285	MN -34D	10:11837
7	NTIS, PC A02; 3	DE85004962	MN -34D	10:11543
CONF-840415-	(187. national meeting of the American Chemical Society, St. Louis, MO, USA, 8-13 Apr 1984)			
27	*See* RFP-3685	E 1.99: DE85004970	MN -10	10:11464
CONF-8404157-	(19. winter school on physics, Zakopane, Poland, 3-15 Apr 1984)			
3	*See* GSI-84-43(Prepr.)	DE85750271	MN -34C	10:11767
CONF-8404201-	(23. annual Kentucky industrial coal conference, Lexington, KY, USA, 11-12 Apr 1984)			
3	University of Kentucky, 112 Frazer Hall, Lexington, KY	TI85900890	MN -90j	10:11214
9	University of Kentucky, 112 Frazer Hall, Lexington, KY	TI85900886	MN -90e	10:10920
10	University of Kentucky, 112 Frazer Hall, Lexington, KY	TI85900896	MN -90e	10:10921

Report Number	Availability Source	File Number		Distribution Category	Abstract Number
CONF-8404215-	(12. international winter meeting on fundamental physics, Santillana del Mar, Santa, Spain, 9-14 Apr 1984)				
2	*See* DOE/ER/40025-19	E 1.99:	DE85004866	MN -34D	10:11821
CONF-8404218-	(Americium Chemical Society meeting, Denver, CO, USA, 19 Apr 1984)				
1	*See* RFP-3652	E 1.99:	DE85005176	MN -10	10:10957
CONF-8404219-	(IUTAM/ICF/ICM Eshelby memorial symposium, Sheffield, UK, 2-5 Apr 1984)				
1	NTIS, PC A02; 3		DE85003937	MN -25	10:11332
CONF-8404225-	(2. international conference on recent advances in structural dynamics, Southampton, UK, 9-13 Apr 1984)				
	See AD-P-003642/6				10:11121
CONF-8405162-	(Symposium on recent developments in computing, processor, and software research for high-energy physics, Guanajuato, Mexico, 8-11 May 1984)				
7	*See* BONN-HE-84-11		DE85750275	MN -28	10:11556
CONF-8405216-	(AAPG annual convention, San Antonio, TX, USA, 20-23 May 1984)				
1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004508	MN -92	10:10940
CONF-8405241-	(Seminar on perspectives for experimental apparatus at future high energy machines, Florence, Italy, 21-25 May 1984)				
2	*See* DESY-84-049		DE85750283	MN -37	10:11559
CONF-8405264-	(ASEAN conference on energy conservation in buildings, Singapore, Singapore, 1 May 1984)				
1	*See* LBL-18046	E 1.99:	DE85005108	MN -95d	10:11290
CONF-8405265-	(8. actinide separations workshop, Boulder, CO, USA, 30 May 1984)				
1	*See* RFP-3704	E 1.99:	DE85004973	MN -10	10:10986
CONF-8406189-	(4. international conference on ultrarelativistic nucleus-nucleus collisions - QUARK MATTER '84, Helsinki, Finland, 17-24 Jun 1984)				
9	*See* DOE/ER/40025-31	E 1.99:	DE85004035	MN -34D	10:11851
CONF-8406198-	(Design and utilization of the superconducting super collider summer study, Snowmass, CO, USA, 23 Jun-13 Jul 1984)				
26	*See* ANL/HEP-CP-84-81	E 1.99:	DE85005062	MN -28	10:11536
27	*See* ANL/HEP-CP-84-87	E 1.99:	DE85004065	MN -34D	10:11813
31	*See* ANL-HEP-CP-84-86	E 1.99:	DE85004063	MN -28	10:11537
32	*See* ANL-HEP-CP-84-76	E 1.99:	DE85004818	MN -34D	10:11833
34	*See* FNAL/C-84/99-T	E 1.99:	DE85003780	MN -34D	10:11841
36	*See* FNAL/C-84/87-T	E 1.99:	DE85005510	MN -34D	10:11840
37	*See* SLAC-PUB-3509		DE85005537	MN -28	10:11534
CONF-8406207-	(Workshop on coincident particle emission from continuum states (OPECOS '84), Bad Honnef, F.R. Germany, 4-7 Jun 1984)				
2	*See* GSI-84-44(Prepr.)		DE85750270	MN -34C	10:11890
CONF-8406212-	(International school of physics "Enrico Fermi", Varenna, Italy, 18-22 Jun 1984)				
1	*See* GSI-84-47(Prepr.)		DE85750269	MN -34C	10:11884
CONF-8406221-	(7. international seminar on high energy physics problems, multiquark interactions and quantum chromodynamics, Dubna, USSR, 19-23 Jun 1984)				
2	*See* LBL-18309	E 1.99:	DE85004898	MN -28	10:11533
CONF-8406228-	(International workshop on slow positrons in surface science, Pajulahti, Finland, 25-29 Jun 1984)				
1	*See* BNL-35550	E 1.99:	DE85004700	MN -34A	10:11760
2	*See* BNL-35573	E 1.99:	DE85005133	MN -25	10:11761
CONF-8406230-	(American Chemical Society Rocky Mountain regional meeting, Albuquerque, NM, USA, 6-8 Jun 1984)				
1	*See* RFP-3655	E 1.99:	DE85004696	MN -4	10:11347
CONF-8406232-	(ASHRAE international symposium on the interface between the building envelope and HVAC systems, Kansas City, MO, USA, 17-20 Jun 1984)				
1	*See* LBL-17920	E 1.99:	DE85004589	MN -95d	10:11316
CONF-8406233-	(SIAM conference on numerical optimization, Boulder, CO, USA, 12-14 Jun 1984)				
1	*See* SOL-84-10	E 1.99:	DE85004784	MN -32	10:12016
CONF-8406234-	(International symposium on phase transitions in the very early universe, Bielefeld, F.R. Germany, 1 Jun 1984)				
2	*See* FNAL/C-84/117-A	E 1.99:	DE85003924	MN -34B	10:11739
3	*See* FNAL/C-84/105	E 1.99:	DE85003951	MN -34B	10:11737
CONF-840757-	(22. international conference on high energy physics, Leipzig, German D.R., 19-25 Jul 1984)				
27	*See* FNAL/C-84/93-T	E 1.99:	DE85005500	MN -34D	10:11889
CONF-840767-	(Microbeam Analysis Society analytical electron microscopy meeting, Bethlehem, PA, USA, 16-20 Jul 1984)				
16	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85005567	MN -25	10:11439

Report Number	Availability Source	File Number		Distribution Category	Abstract Number
CONF-840828-	(International synfuels policies and technologies symposium, Philadelphia, PA, USA, 19-22 Aug 1984)				
7	*See* PNL-SA-12174	E 1.99:	DE85000366	MN -70	10:10979
CONF-840854-	(Western States mining exposition, Reno, NV, USA, 7-10 Aug 1984)				
1	*See* SAND-84-7211C	E 1.99:	DE85005489	MN -70	10:10991
CONF-840873-	(US summer school on high energy particle accelerator, Batavia, IL, USA, 13-24 Aug 1984)				
4	*See* FNAL/C-84/88-T	E 1.99:	DE85004269	MN -34D	10:11853
CONF-840883-	(International conference on defects in insulating crystals, Salt Lake City, UT, USA, 20-24 Aug 1984)				
2	*See* UCRL-90682	E 1.99:	DE85006156	MN -4	10:11413
CONF-8408104-	(Conference on the physics of very large scale integration (VLSI), Palo Alto, CA, USA, 1-3 Aug 1984) American Institute of Physics, 335 E. 45th Street, New York, NY 10017		TI85002546	ND -34	10:11522
CONF-8408122-	(4. international conference on nuclear war, Erice, Sicily, Italy, 19-24 Aug 1984)				
2	*See* UCRL-91446	E 1.99:	DE85006450	MN -11	10:11597
CONF-8408132-	(Conference on solar neutrinos and neutrino astronomy, Lead, SD, USA, 23-25 Aug 1984)				
3	*See* BNL-35728	E 1.99:	DE85005208	MN -34B	10:11735
4	*See* LA-UR-84-3566	E 1.99:	DE85003747	MN -34B	10:11740
6	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004802	MN -34B	10:11736
7	*See* PNL-SA-12758	E 1.99:	DE85005286	MN -34B	10:11566
CONF-840915-	(13. symposium on fusion technology, Varese, Italy, 24-28 Sep 1984)				
10	*See* LBL-18397		DE85004128	MN -20	10:11977
CONF-840922-	(5. APS topical conference on high temperature plasma diagnostics, Tahoe City, CA, USA, 16-20 Sep 1984)				
20	*See* DOE/ET/51013-134	E 1.99:	DE85004845	MN -20f	10:11930
CONF-840937-	(Applied superconductivity conference, San Diego, CA, USA, 9-13 Sep 1984)				
23	*See* LBL-17748		DE85004900	MN -34	10:11913
27	*See* BNL-35374	E 1.99:	DE85005121	MN -38	10:11481
CONF-840942-	(16. ICHMT symposium on heat and mass transfer in fixed and fluidized beds, Dubrovnik, Yugoslavia, 3-7 Sep 1984)				
	Amsterdam ,Netherlands.; North Holland (May 1984).			MN -25	10:11988
CONF-840954-	(9. national passive solar conference, Columbus, OH, USA, 23-27 Sep 1984)				
11	*See* LBL-18248	E 1.99:	DE85005164	MN -59B	10:11291
CONF-8409161-	(5. symposium on neutron dosimetry, Munich, F.R. Germany, 17-21 Sep 1984)				
4	*See* PNL-SA-12071	E 1.99:	DE85005518	MN -34C	10:11901
CONF-8409169-	(Society for Risk Analysis annual meeting, Knoxville, TN, USA, 30 Sep-3 Oct 1984)				
3	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85005361	MN -41	10:11608
CONF-8409179-	(American Institute of Mining, Metallurgical and Petroleum Engineers conference, Detroit, MI, USA, 17-21 Sep 1984)				
5	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE85002768	MN -25	10:11333
CONF-8409194-	(6. international workshop on photon-photon collisions, Lake Tahoe, CA, USA, 9-13 Sep 1984)				
1	*See* LBL-18701	E 1.99:	DE85004607	MN -34D	10:11842
CONF-8409196-	(CAL/SEIA annual meeting on technology transfer, Anaheim, CA, USA, 15 Sep 1984)				
1	*See* BNL-35279	E 1.99:	DE85004160	MN -59B	10:11054
CONF-8409197-	(Workshop on unconventional imagery, Rigi-Kaltbad-First, Switzerland, 24 Sep 1984,-22 Sep 2517)				
1	*See* UCRL-91408	E 1.99:	DE85004993	MN -32	10:11918
CONF-841003-	(Personnel radiation dosimetry symposium, Knoxville, TN, USA, 15-18 Oct 1984)				
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85005371	MN -41	10:11903
CONF-841005-	(Instrumentation for heavy ion nuclear research conference, Oak Ridge, TN, USA, 22-26 Oct 1984)				
4	*See* LBL-18626	E 1.99:	DE85004590	MN -34C	10:11550
5	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85005370	MN -28	10:11541
CONF-841007-	(Nuclear science symposium, Orlando, FL, USA, 31 Oct-2 Nov 1984)				
38	*See* LBL-18557	E 1.99:	DE85004901	MN -38	10:11517
40	*See* SLAC-PUB-3455	E 1.99:	DE85004676	MN -28	10:11552
41	*See* SLAC-PUB-3511	E 1.99:	DE85004677	MN -38	10:11520
42	*See* SLAC-PUB-3465	E 1.99:	DE85004679	MN -28	10:11567
43	*See* SLAC-PUB-3466	E 1.99:	DE85004678	MN -28	10:11553
44	*See* ANL-HEP-CP-84-77	E 1.99:	DE85004817	MN -34C	10:11558
45	*See* SLAC-PUB-3471	E 1.99:	DE85004681	MN -28	10:11554
46	*See* SLAC-PUB-3491	E 1.99:	DE85004680	MN -28	10:11569
48	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85005356	MN -28	10:12009
50	*See* SLAC-PUB-3475	E 1.99:	DE85005533	MN -28	10:11568
51	*See* SLAC-PUB-3502		DE85005535	MN -34D	10:11570

Report Number	*Availability Source*	*File Number*		*Distribution Category*	*Abstract Number*
CONF-841021-	(6. SERI photovoltaic research and development review meeting, Golden, CO, USA, 29-31 Oct 1984)				
Absts.	*See* SERI/CP-211-2507	E 1.99:	DE84013047	MN -63	10:11035
CONF-8410103-	(Automotive technology development contractors' coordination meeting, Dearborn, MI, USA, 29 Oct-2 Nov 1984)				
3	*See* DOE/NASA/51040-59	E 1.99:	DE85004683	STD -25	10:11317
4	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004797	MN -25	10:11404
CONF-8410112-	(Symposium on polymer research at synchrotron radiation sources, Upton, NY, USA, 29-31 Oct 1984)				
3	*See* BNL-35486	E 1.99:	DE85004189	MN -28	10:11539
CONF-8410142-	(12. water reactor safety research information meeting, Gaithersburg, MD, USA, 23-26 Oct 1984)				
10	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85000270	MN -78	10:11158
30	*See* SAND-84-1845C	E 1.99:	DE85002640	MN -78	10:11171
34	*See* SAND-84-2282C	E 1.99:	DE85002622	MN -78	10:11173
65	*See* SAND-84-2216C	E 1.99:	DE85003340	MN -78	10:11172
70	*See* PNL-SA-12703	E 1.99:	TI85004546	MN -41	10:11905
CONF-8410144-	(International symposium on nuclear shell model, Philadelphia, PA, USA, 31 Oct-3 Nov 1984)				
4	*See* LA-UR-84-3812	E 1.99:	DE85005727	MN -34C	10:11879
CONF-8410161-	(18. European symposium on calcified tissue, Angers, France, 11-18 Oct 1984)				
3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85005025	MN -48	10:11672
CONF-8410165-	(DOE model validation workshop, Charleston, SC, USA, 23-26 Oct 1984)				
3	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85004073	MN -11	10:11588
4	*See* UCRL-91854	E 1.99:	DE85004989	MN -11	10:11599
CONF-8410170-	(Monte Carlo methods in nuclear reactor analysis, Ispra, Italy, 8-12 Oct 1984)				
3	NTIS, PC A03; 3		DE85002577	MN -80	10:11119
4	NTIS, PC A06; 3		DE85002578	MN -80	10:11120
CONF-8410172-	(Symposium of northeastern accelerator personnel, Stony Brook, NY, USA, 15-18 Oct 1984)				
5	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85005372	MN -28	10:11530
CONF-8410173-	(International meeting on reduced enrichment for research and test reactors, Argonne, IL, USA, 14-18 Oct 1984)				
6	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85005058	MN -80	10:11129
9	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85005060	MN -80	10:11133
10	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85005048	MN -41	10:11159
11	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85005047	MN -80	10:11134
CONF-8410202-	(IUCF workshop on nuclear physics with stored cooled beams, Spencer, IN, USA, 14-17 Oct 1984)				
2	*See* TRI-PP-84-100		DE85900432	MN -34C	10:11867
3	*See* ANL-HEP-CP-84-82	E 1.99:	DE85005028	MN -34C	10:11865
CONF-8410203-	(9. All-Union conference on charged particle accelerators, Dubna, USSR, 16-18 Oct 1984)				
2	*See* LBL-18546	E 1.99:	DE85005109	MN -28	10:11549
CONF-8410206-	(Workshop on cosmic ray and high energy gamma ray experiments for the space station ERA, Baton Rouge, LA, USA, 17-20 Oct 1984)				
1	*See* LBL-18708		DE85004606	MN -34C	10:11877
CONF-8410207-	(Conference on corrosion chemistry within pits, crevices and cracks, Teddington, UK, 1-3 Oct 1984)				
1	*See* BNL-35432	E 1.99:	DE85005207	MN -25	10:11325
CONF-8410208-	(ASM international conference on corrosion of nickel base alloys, Cincinnati, OH, USA, 23-25 Oct 1984)				
1	*See* BNL-NUREG-35520		TI85005129	MN -25	10:11327
2	*See* PNL-SA-12341	E 1.99:	DE85004547	MN -25	10:11346
CONF-8410209-	(Safeguards symposium, Richland, WA, USA, 18 Oct 1984)				
1	*See* UNI-SA-138	E 1.99:	DE85004550	MN -85	10:10965
CONF-8410210-	(7. high energy heavy ion study conference, Darmstadt, F.R. Germany, 8-13 Oct 1984)				
1	*See* LBL-18697	E 1.99:	DE85004611	MN -34C	10:11893
2	*See* LBL-18726	E 1.99:	DE85005482	MN -34D	10:11873
3	*See* LBL-18712	E 1.99:	DE85004608	MN -34C	10:11871
CONF-841105-	(Joint meeting of the American Nuclear Society and the Atomic Industrial Forum, Washington, DC, USA, 11-16 Nov 1984)				
50	*See* PNL-SA-12393	E 1.99:	DE85004556	MN -70	10:10985
52	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85005382	MN -79p	10:11155
54	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85005377	MN -79	10:11156
57	NTIS, PC A02/MF A01 - GPO		TI85005369	MN -78	10:11157
58	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85005378	MN -86	10:10963
59	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85005360	MN -4	10:11440
CONF-841106-	(Inter-regional seminar on practical problems encountered in the safe transport of radioactive materials, Vienna, Austria, 5-8 Nov 1984)				
1	*See* EGG-M-24584	E 1.99:	DE85004317	MN -34C	10:11883
CONF-841115-	(International conference on power plant simulation, Mexico City, Mexico, 19-21 Nov 1984)				
7	*See* EGG-M-22484	E 1.99:	DE85005172	MN -78	10:11094

Report Number	Availability Source	File Number	Distribution Category	Abstract Number
CONF-841117-	(8. conference on the application of accelerators in research and industry, Denton, TX, USA, 12-14 Nov 1984)			
27	*See* BNL-35495	E 1.99: DE85005131	MN -28	10:11540
29	*See* BNL-35312	E 1.99: DE85005128	MN -28	10:11759
30	*See* BNL-35311	E 1.99: DE85004059	MN -28	10:11538
33	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85005027	MN -28	10:11542
34	*See* LBL-18731	E 1.99: DE85004592	MN -34C	10:11551
35	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85005374	MN -25	10:11388
37	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85005259	MN -4	10:11762
40	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85005266	MN -4	10:11763
41	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85005260	MN -34C	10:11868
CONF-841121-	(AIChE annual meeting, San Francisco, CA, USA, 25-29 Nov 1984)			
12	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE85005075	MN -90c	10:10829
CONF-841122-	(Symposium on new technologies in nuclear power plant instrumentation and control, Washington, DC, USA, 28-30 Nov 1984)			
2	*See* EGG-M-16284	E 1.99: DE85004893	MN -80	10:11093
3	*See* EGG-M-25484	E 1.99: DE85004693	MN -32	10:12012
CONF-841136-	(6. annual North American meeting of the International Association of Energy Economists, San Francisco, CA, USA, 5-7 Nov 1984)			
3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85004084	MN -11	10:11184
4	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85005022	MN -98	10:11219
CONF-841142-	(Symposium on environmental research for actinide elements, Hilton Head Island, SC, USA, 7-11 Nov 1984)			
2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85005383	MN -11	10:11619
CONF-841157-	(Symposium on the scientific basis for nuclear waste management, Boston, MA, USA, 26-29 Nov 1984)			
23	*See* SAND-84-1230C	E 1.99: DE85003677	MN -25	10:11349
40	*See* PNL-SA-12320	E 1.99: DE85004557	MN -25	10:10982
41	*See* PNL-SA-12304	E 1.99: DE85004535	MN -25	10:10980
42	*See* PNL-SA-12314	E 1.99: DE85004555	MN -25	10:10981
43	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85005367	MN -25	10:11328
44	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85004801	MN -25	10:11405
47	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85004857	MN -25	10:11406
48	*See* PNL-SA-12310	E 1.99: DE85004552	MN -25	10:11410
49	*See* PNL-SA-12326	E 1.99: DE85004553	MN -25	10:11345
51	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85005263	MN -25	10:11329
52	*See* SAND-84-1324C	E 1.99: DE85005481	MN -25	10:11412
53	*See* SAND-84-1292C	E 1.99: DE85005483	MN -25	10:11350
54	*See* PNL-SA-12360	E 1.99: DE85005291	MN -70	10:10984
55	*See* PNL-SA-12355	E 1.99: DE85005293	MN -70	10:10983
57	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85005261	MN -25	10:11407
58	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85005262	MN -25	10:11330
60	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85005241	MN -25	10:11331
61	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85005265	MN -90i	10:10863
CONF-841184-	(30. annual conference on magnetism and magnetic materials, San Diego, CA, USA, 27-30 Nov 1984)			
24	NTIS, PC A02/MF A02 (GPO Dep.)	E 1.99: DE85004069	MN -34C	10:11389
26	*See* LBL-18298	E 1.99: DE85004981	MN -28	10:11532
CONF-841187-	(5. DOE environmental protection information meeting, Albuquerque, NM, USA, 6-8 Nov 1984)			
20	*See* PNL-SA-12709	E 1.99: DE85003601	MN -11	10:11633
24	*See* EGG-10282-1069	DE85004865	MN -41	10:11620
25	*See* EGG-10282-1067	DE85004863	MN -41	10:11622
26	*See* EGG-10282-1068	DE85004864	MN -41	10:11623
27	*See* EGG-10282-1070	E 1.99: DE85004867	MN -41	10:11624
CONF-841194-	(Southeast industrial biomass energy exposition, Atlanta, GA, USA, 28-29 Nov 1984)			
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85005068	MN -61E	10:11012
CONF-8411100-	(International conference on applied lasers and electro optics, Boston, MA, USA, 12-15 Nov 1984)			
3	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85005236	MN -4	10:11467
CONF-8411109-	(Workshop on inelastic deformation and failure modes, Evanston, IL, USA, 18-21 Nov 1984)			
3	*See* SAND-84-2304C	E 1.99: DE85004460	MN -38	10:11478
CONF-8411118-	(Meeting on nuclear standard reference data, Geel, Belgium, 12-16 Nov 1984)			
5	*See* BNL-NCS-35522	E 1.99: DE85004712	MN -34C	10:11881
8	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85005019	MN -34C	10:11862
10	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85005049	MN -34C	10:11882
CONF-8411125-	(Process simulation symposium, Wilmington, DE, USA, 8-9 Nov 1984)			
1	*See* DP-MS-84-100	E 1.99: DE85003656	MN -22	10:11137
CONF-8411132-	(International conference on ground-water technology, Johannesburg, South Africa, 13-15 Nov 1984)			
1	*See* PNL-SA-12151	E 1.99: DE85004537	MN -11	10:11632
CONF-8411133-	(11. Japanese seminar on properties and applications of amorphous semiconductors, Tokyo, Japan, 26-28 Nov 1984)			
1	*See* BNL-35564	E 1.99: DE85005137	MN -25	10:11387

Report Number	Availability Source	File Number		Distribution Category	Abstract Number
CONF-8411134-	(3. symposium on heavy gases and risk assessment, Bonn, F.R. Germany, 12-13 Nov 1984)				
2	*See* UCRL-91830	E 1.99:	DE85004988	MN -11	10:11598
CONF-8411135-	(Institute of Nuclear Materials Management regional meeting, Oak Ridge, TN, USA, 8-9 Nov 1984)				
1	*See* BNL-35510	E 1.99:	DE85004704	MN -16	10:11004
CONF-8411137-	(National acid precipitation assessment program meeting, Asheville, NC, USA, 13-16 Nov 1984)				
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85005257	MN -11	10:11617
CONF-8411138-	(Direct coal liquefaction contractor's review conference, Pittsburgh, PA, USA, 16 Nov 1984)				
1	*See* PNL-SA-11623	E 1.99:	DE85004545	MN -90d	10:10862
2	*See* PNL-SA-11622	E 1.99:	DE85004558	MN -90d	10:10861
CONF-841201-	(ASME winter annual meeting, New Orleans, LA, USA, 9-13 Dec 1984)				
26	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85005276	MN -86	10:10964
CONF-841210-	(International chemical congress of Pacific Basin Society, Honolulu, HI, USA, 16-21 Dec 1984)				
3	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85004413	MN -10	10:11473
7	*See* SAND-84-0959C	E 1.99:	DE85003950	MN -4	10:11915
10	*See* LA-UR-84-3810	E 1.99:	DE85005726	MN -10	10:11342
11	*See* SAND-84-0862C	E 1.99:	DE85005590	MN -25	10:11411
CONF-841218-	(31. national vacuum symposium, Reno, NV, USA, 3-7 Dec 1984)				
15	*See* LBL-18010	E 1.99:	DE85004980	MN -20a	10:11935
20	*See* LA-UR-84-3805	E 1.99:	DE85005723	MN -25	10:11768
CONF-841234-	(International electron devices meeting, San Francisco, CA, USA, 10-12 Dec 1984)				
4	NTIS, PC A02; 3		DE85005283	MN -20	10:11973
CONF-841245-	(Geochemistry of radionuclides migration, Argonne, IL, USA, 3-6 Dec 1984)				
1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85006226	MN -70	10:10998
CONF-841246-	(1. international conference on fusion reactor materials, Tokyo, Japan, 3-6 Dec 1984)				
8	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85005346	MN -20c	10:11974
10	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85005363	MN -20	10:11975
11	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85004814	MN -20	10:11390
CONF-841247-	(4. simposio chileno de fisica, Santiago, Chile, 26-28 Dec 1984)				
3	*See* LBL-18681	E 1.99:	DE85004603	MN -34D	10:11914
CONF-841255-	(23. IEEE conference on decision and control, Las Vegas, NV, USA, 12-14 Dec 1984)				
1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004780	MN -32	10:11926
CONF-850101-	(International congress on hydrology of rocks of low permeability, Tucson, AZ, USA, 7-12 Jan 1985)				
4	*See* LBL-17514	E 1.99:	DE85004593	MN -11	10:11725
CONF-850137-	(International Society for Optical Engineering meeting, Los Angeles, CA, USA, 21-25 Jan 1985)				
1	*See* BNL-35551	E 1.99:	DE85005124	MN -32	10:12008
CONF-850138-	(Cooling Tower Institute meeting, New Orleans, LA, USA, 21-23 Jan 1985)				
1	*See* K/P-6816	E 1.99:	DE85004173	MN -25	10:11484
CONF-850206-	(International ANS/ENS topical meeting on probabilistic safety methods and applications, San Francisco, CA, USA, 24-28 Feb 1985)				
14	*See* SAND-84-1843C	E 1.99:	DE85004012	MN -78	10:11170
CONF-850311-	(National Association of Corrosion Engineers annual meeting and materials performance and corrosion show, Boston, MA, USA, 25-29 Mar 1985)				
6	*See* BNL-35568	E 1.99:	DE85004702	MN -25	10:11326
CONF-850399-	(International conference on acoustics, speech and signal processing (ICASSP), Tampa, FL, USA, 26-29 Mar 1985)				
1	*See* SAND-84-2526C	E 1.99:	DE85003946	MN -32	10:11928
CONF-850712-	(21. AIAA/ASME/SAE joint propulsion conference, Monterey, CA, USA, 8-10 Jul 1985)				
3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004083	MN -38	10:11507
COO-					
2718-12	*See* DOE/ER/13237-T1	E 1.99:	DE85004884	MN -34A	10:11766
CREARE/TM-					
977	*See* FSEC-CR-108-84	E 1.99:	DE85005221	STD -64	10:11050
CTA-IEAV-NT-					
010/ 83	NTIS (US Sales Only), PC A03/MF A01		DE84703446	MN -78	10:11092
DESY-					
84-049	NTIS (US Sales Only), PC A03/MF A01		DE85750283	MN -37	10:11559
84-050	NTIS (US Sales Only), PC A03/MF A01		DE85750282	MN -34D	10:11814
84-051	NTIS (US Sales Only), PC A02/MF A01		DE85750280	MN -34D	10:11815
84-052	NTIS (US Sales Only), PC A02/MF A01		DE85750278	MN -34D	10:11816
84-053	NTIS (US Sales Only), PC A02/MF A01		DE85750281	MN -34D	10:11835
84-055	NTIS (US Sales Only), PC A03/MF A01		DE85750284	MN -34D	10:11836
84-056	NTIS (US Sales Only), PC A02/MF A01		DE85750285	MN -34D	10:11837
84-059	NTIS (US Sales Only), PC A02/MF A01		DE85750288	MN -34D	10:11817
84-060	NTIS (US Sales Only), PC A03/MF A01		DE85750287	MN -34D	10:11557
84-061	NTIS (US Sales Only), PC A02/MF A01		DE85750286	MN -34D	10:11818

Report Number	Availability Source	File Number		Distribution Category	Abstract Number
DO-TH-83-16	See N-84-30939				10:11825
DOE/AL/16222-T1	NTIS, PC A09/MF A01 (GPO Dep.)	E 1.99:	DE85004586	STD -59A	10:11055
DOE/BC-84/ 3	NTIS, PC A07/MF A01 (GPO Dep.)	E 1.99:	DE85000107	STD -92a	10:10935
DOE/CE/15101-T1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE84015357	MN -95f	10:11308
DOE/CS/10118-T1-Vol.1	NTIS, PC A07/MF A01 (GPO Dep.)	E 1.99:	DE85005076	MN -98D	10:11220
T1-Vol.2	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99:	DE85005077	MN -98D	10:11221
T2	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE85005078	MN -98D	10:11222
DOE/CS/30076-T1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85005387	MN -63	10:11042
DOE/CS/31587-T3-Vol.1	NTIS, PC A07/MF A01; 1 (GPO Dep.)	E 1.99:	DE85003217	STD -59A	10:11051
T3-Vol.2	NTIS, PC A10/MF A01; 1 (GPO Dep.)	E 1.99:	DE85003218	STD -59A	10:11052
DOE/CS/35308-T1	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85005414	MN -59B	10:11056
DOE/CS/40442-T1	NTIS, PC A08/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004516	MN -95f	10:11391
DOE/CS/94277-T1	NTIS, PC A09/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004958	MN -63a	10:11043
DOE/DP-0021	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE84017499	MN -2	10:12024
DOE/EA-0118	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE85003488	MN -78	10:11125
DOE/EI/06540-T1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE85005649	MN -92a	10:10934
DOE/EIA-0121(84/ 3Q)	NTIS, PC A06/MF A01; 1 - GPO (GPO Dep.)	E 1.99:	DE85006484	MN -98A	10:10930
0130(84/ 10)	NTIS, PC A10/MF A01; 1 - GPO (GPO Dep.)	E 1.99:	DE85004717	MN -98C	10:10947
0380(84/ 10)	NTIS, PC A07/MF A07; 1 - GPO (GPO Dep.)	E 1.99:	DE85005436	MN -98B	10:10941
0438(84)	NTIS, PC A06/MF A01; 1 - GPO (GPO Dep.)	E 1.99:	DE85004323	MN -98	10:11074
M002	NTIS, PC APC A03/MF A01 - GPO (GPO Dep.)	E 1.99:	DE85006325	MN -98	10:11182
DOE/ER-0192	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE85004977	MN -05	10:12025
0210	NTIS, PC A14/MF A01 (GPO Dep.)	E 1.99:	DE85005641	MN -34D	10:11809
0212	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85005642	MN -25	10:11322
DOE/ER/04075-T3	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85005478	MN -25	10:11392
DOE/ER/04699-8	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004877	MN -34C	10:11875
DOE/ER/06042-5	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85006486	MN -4	10:11441
DOE/ER/10366-5	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85006301	MN -4	10:11468
DOE/ER/10407-5	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85006482	MN -34C	10:11866
DOE/ER/10431-1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85005475	MN -34A	10:11764
DOE/ER/10453-04	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85005404	MN -25	10:11408
DOE/ER/10505-4	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85006173	MN -4	10:11475
DOE/ER/10575-T2	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004922	MN -62b	10:11057
DOE/ER/10699-T4	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004841	MN -34D	10:11819
DOE/ER/12054-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85005406	MN -38	10:11483
DOE/ER/13019-2	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004783	MN -63	10:11025
DOE/ER/13041-T2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004885	MN -34A	10:11765
DOE/ER/13122-1	NTIS, PC A02; 3		DE85004869	MN -32	10:12010
DOE/ER/13167-2	NTIS, PC A02/MF A01 - GPO		TI85004858	MN -34A	10:11802
DOE/ER/13175-1	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85005585	MN -4	10:11427
DOE/ER/13216-1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85004871	MN -11	10:11724
DOE/ER/13224-T1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85004934	MN -90a	10:11476
DOE/ER/13237-T1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85004884	MN -34A	10:11766
DOE/ER/40008-68	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85004859	MN -34D	10:11838
DOE/ER/40025-17	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85004840	MN -34D	10:11820
19	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004866	MN -34D	10:11821
27	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004873	MN -28	10:11544
31	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004035	MN -34D	10:11851

Report Number	Availability Source	File Number	Distribution Category	Abstract Number
T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85005015	MN -34D	10:11560
T2	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85005409	MN -34D	10:11906
DOE/ER/40033-55	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85004842	MN -34D	10:11839
70	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85004795	MN -34D	10:11822
DOE/ER/40145-1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99: DE85005609	MN -34C	10:11887
DOE/ER/40146-1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85004886	MN -34C	10:11545
DOE/ER/40154-1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85006172	MN -34C	10:11888
DOE/ER/45098-5	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85004882	MN -25	10:11334
DOE/ER/60095-T3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85005421	MN -41	10:11609
DOE/ET/10137-T11	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE85004310	STD -90d	10:10830
DOE/ET/13077-101	NTIS, PC A04; 3	DE85006483	MN -92a	10:10936
DOE/ET/15440-19	NTIS, PC A07/MF A01; 1 (GPO Dep.)	E 1.99: DE84016839	STD -93	10:11273
DOE/ET/17076-T1	NTIS MF A01; 2 (GPO Dep.)	E 1.99: DE85006293	MN -93	10:11274
DOE/ET/20645-1	NTIS, PC A14/MF A01; 1 (GPO Dep.)	E 1.99: DE85000736	STD -59A	10:11053
DOE/ET/29040-1	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99: TI85003571	MN -97	10:11065
DOE/ET/32041-T1	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE85006459	MN -98F	10:11208
DOE/ET/51013-122	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85004914	MN -21	10:11976
134	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85004845	MN -20f	10:11930
DOE/ET/53043-T2	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE85004599	MN -20	10:11931
DOE/ET/53088-162	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85005554	MN -20	10:11932
DOE/EV/00637-13	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85004856	MN -48	10:11668
DOE/EV/02217-51	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE85004289	MN -48	10:11686
DOE/EV/10237-T1	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99: DE85004721	MN -90a	10:10850
DOE/EV/10331-4	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE85004888	MN -11	10:11729
DOE/EV/10415-2	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85005417	MN -48	10:11664
T1	NTIS, PC A07/MF A01; 1 (GPO Dep.)	E 1.99: DE85006297	MN -11	10:11615
DOE/EV/10564-T1	NTIS, PC A05; 3	DE85005452	MN -48	10:11673
DOE/EV/10665-5	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85004507	MN -11	10:11586
DOE/FE-0046	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85005731	STD -92	10:10949
DOE/FE/60148-T9	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE85005646	MN -90a	10:10864
T10	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE85005647	MN -90a	10:10865
T11	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99: DE85005648	MN -90a	10:10866
DOE/FE/60338-16	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE85004716	MN -93	10:11275
DOE/FE/60339-T7	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99: DE85000035	STD -90e	10:10831
DOE/FE/60406-T1-Vol.4	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99: DE85005082	MN -11	10:11627
DOE/HIR-85/ 1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85003160	STD -34C	10:11863
DOE/IR/10297-T2	NTIS, PC A14/MF A01 (GPO Dep.)	E 1.99: DE85006476	MN -98C	10:10953
DOE/LC/10652-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85005418	MN -90	10:10853
DOE/LC/10747-T10	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99: DE85006462	MN -91	10:10955
DOE/MA-0142/ 1	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE85006181	MN -13	10:12003
DOE/MC/14615-T1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99: DE85005275	MN -90c	10:10835
DOE/MC/15078-7-3	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85005423	MN -93	10:11276
DOE/MC/16426-14	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85005617	MN -92a	10:10937
DOE/MC/19363-1713	NTIS, PC A08/MF A01; 1 (GPO Dep.)	E 1.99: DE85005329	STD -90e	10:11524
DOE/MC/20035-1702	NTIS, PC A11/MF A01; 1 (GPO Dep.)	E 1.99: DE85001988	STD -90c	10:10867

Report Number	*Availability Source*	*File Number*	*Distribution Category*	*Abstract Number*
DOE/MC/20122-T1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE85005326	MN -90b	10:10910
DOE/MC/20228-T1	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99: DE85005412	MN -90e	10:10924
DOE/MC/20334-T14	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85004794	MN -90e	10:11525
DOE/MC/20370-1700	NTIS, PC A08/MF A01; 1 (GPO Dep.)	E 1.99: DE85001987	STD -92a	10:10950
DOE/NASA/51040-59	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85004683	STD -25	10:11317
DOE/NBM-1078	NTIS, PC A07/MF A01 (GPO Dep.)	E 1.99: DE85003670	STD -13	10:12026
5004071	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85004071	MN -32	10:11803
DOE/NV/10045-1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99: DE85005477	MN -41	10:11635
DOE/NV/10162-19	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE85004076	MN -11	10:11185
DOE/NV/10250-17	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE85005635	MN -70	10:10968
DOE/OR-853	NTIS, PC A20/MF A01; 1 (GPO Dep.)	E 1.99: DE85005424	STD -70A	10:10969
DOE/OR/03054-108	NTIS, PC A10/MF A01; 1 (GPO Dep.)	E 1.99: DE85001632	STD -89	10:10836
121	NTIS, PC A14/MF A01; 1 (GPO Dep.)	E 1.99: DE85004933	STD -89	10:10837
T24	NTIS, PC A03; 3	DE85001616	MN -89	10:10838
T37-Vol.1	NTIS, PC A23/MF A01; 1 (GPO Dep.)	E 1.99: DE85001562	STD -89	10:10839
DOE/OR/20722-3	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99: DE85004928	MN -11	10:10970
17	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE85004932	MN -11	10:10971
DOE/OR/20992-T1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85006097	MN -90h	10:10840
DOE/OR/21400-T81	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85005354	MN -59B	10:11061
T82	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85005355	MN -94a	10:11286
T85	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99: DE85005327	MN -90h	10:11335
DOE/PC/40275-2	NTIS, PC A07/MF A01; 1 (GPO Dep.)	E 1.99: DE85004103	MN -90d	10:11013
DOE/PC/50053-T6	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99: DE85005209	MN -90d	10:10841
DOE/PC/52274-T5	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE85005438	MN -88	10:10894
DOE/PC/60261-T4	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85005608	MN -90i	10:10868
T5	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE85005655	MN -90i	10:10869
DOE/PC/60806-T2	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE85003708	STD -90b	10:10911
DOE/PC/60812-T3	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85004237	MN -90d	10:11458
T4	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85004233	MN -90d	10:11459
T5	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85004234	MN -90d	10:11460
DOE/PC/63032-T5	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85004377	MN -90b	10:10842
DOE/PC/63048-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85004236	MN -90b	10:10912
DOE/PC/70775-1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85005216	MN -90e	10:10925
DOE/PE-0069	NTIS, PC A10/MF A01; 1 (GPO Dep.)	E 1.99: DE85004930	STD -92	10:10948
DOE/PE/06322-T1	NTIS, PC A09/MF A01; 1 (GPO Dep.)	E 1.99: DE85005386	MN -96	10:11210
DOE/PE/70290-T1	W.H. Freeman and Co., 41 Madison Ave., New York, NY 10010	TI85005416	ND -13	10:11183
DOE/PE/70522-T1	NTIS, PC A05/MF A01 (GPO Dep.)	E 1.99: DE85005211	MN -11	10:11186
DOE/R0/00040-T1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85004506	MN -61	10:11014
DOE/R0/01261-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85004496	MN -96	10:11015
DOE/R0/01326-T1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85004504	MN -95f	10:11669
DOE/R4/10164-T1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85005449	MN -95	10:11287
DOE/R4/10228-T1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85005448	MN -61E	10:11016
DOE/R4/10300-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85005446	MN -61E	10:11017
DOE/R4/10452-T1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85005445	MN -95d	10:11288
DOE/R4/10460-T1	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85005435	MN -61E	10:11020
DOE/RA/32012-T27	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99: DE85005451	MN -98B	10:10954

Report Number	Availability Source	File Number		Distribution Category	Abstract Number
DOE/RA/50158-					
1	NTIS, PC A13/MF A01; 1 (GPO Dep.)	E 1.99:	DE85002898	STD -97d	10:11070
DOE/RA/50292-					
T2	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004378	MN -60	10:11063
DOE/RL/01830-					
T31	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85004847	MN -90	10:10843
DOE/SF/00515-					
T42	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85005437	MN -28	10:11546
DOE/SF/11646-					
T1	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85005470	MN -59A	10:11058
DOE/SF/11647-					
T1	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99:	DE85005419	MN -61	10:11223
DOE/TIC-					
3401	NTIS, PC A22/MF A01; 1		DE83015291	STD -90c	10:10844
DOE/TRU-					
8201	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004302	MN -70	10:10972
DOUNREAY-TRANS-					
892	NTIS (US Sales Only), PC A02/MF A01; 1		DE85900013	MN -25	10:11385
DP-					
1694	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85005638	STD -4	10:10999
DP-MS-					
84-100	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85003656	MN -22	10:11137
DR-					
3	*See* AD-A-143449/7				10:11495
EDP-					
29	Energy Research Group, Dept. Physics, Cavendish Lab., Univ. Cambridge, Cambridge CB3 0HE, price Pound 6.00 (GB), Pound 8.50 (overseas)			ND -2	10:11209
EEB-W-					
84-09	*See* LBL-17920	E 1.99:	DE85004589	MN -95d	10:11316
EGG-					
10282-1067	NTIS, PC A03; 3		DE85004863	MN -41	10:11622
10282-1068	NTIS, PC A02; 3		DE85004864	MN -41	10:11623
10282-1069	NTIS, PC A02; 3		DE85004865	MN -41	10:11620
10282-1070	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85004867	MN -41	10:11624
EGG-IS-					
6494(1-85)	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85006108	MN -32	10:12011
EGG-M-					
16284	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004893	MN -80	10:11093
22484	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85005172	MN -78	10:11094
24584	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85004317	MN -34C	10:11883
25484	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004693	MN -32	10:12012
EPA-					
600/ 3-84/ 079	*See* PB-84-223627				10:11590
600/ D-84-195	*See* PB-84-224443				10:11527
600/ D-84/ 197	*See* PB-84-225010				10:11631
600/ S4-84-055	NTIS, PC A02/MF A01		TI85900742	MN -11	10:10942
EPRI-EL-					
3775	Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303, $25.00		TI85920130	ND -97	10:11066
EPRI-NP-					
1850-CCM-Vol.2-Rev.2	Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303		TI85920126	ND -78	10:11175
1850-CCM-Vol.3-Rev.2	Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303		TI85920102	ND -78	10:11174
3243-CCM-Vol.2	NTIS PC E06/MF A01; 1 - EPRI $14.50 (GPO Dep.)	E 1.99:	DE85003280	MN -78	10:11160
3574-SR	Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303, $26.50		TI85920098	ND -78	10:11095
3684-SR-Vol.2	Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303, $50.50		TI85920099	ND -78	10:11077
3703	Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303		TI85920104	ND -78	10:11096
3718	Research Reports Center, P.O. Box 50490, Palo Alto, CA 94303, $10.00		TI85920145	ND -78	10:11097
FCR-					
6523	*See* DOE/ET/15440-19	E 1.99:	DE84016839	STD -93	10:11273
6673F	*See* DOE/FE/60338-16	E 1.99:	DE85004716	MN -93	10:11275
6827P	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85006349	MN -93	10:11277
FE-					
2247-37	*See* DOE/ET/10137-T11	E 1.99:	DE85004310	STD -90d	10:10830
FNAL/C-					
84/ 87-T	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85005510	MN -34D	10:11840
84/ 88-T	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004269	MN -34D	10:11853
84/ 93-T	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85005500	MN -34D	10:11889
84/ 99-T	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85003780	MN -34D	10:11841
84/ 105	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85003951	MN -34B	10:11737
84/ 111-A	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85003922	MN -34B	10:11738
84/ 117-A	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85003924	MN -34B	10:11739
FRCR-					
269	*See* DOE/ET/53043-T2	E 1.99:	DE85004599	MN -20	10:11931

Report Number	Availability Source	File Number		Distribution Category	Abstract Number
FSEC-CR-					
108-84	NTIS, PC A17/MF A01; 1 (GPO Dep.)	E 1.99:	DE85005221	STD -64	10:11050
GAO/RCED-					
84-149	General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760		TI85900449	MN -80	10:11115
84-186	US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760		TI85900445	MN -80	10:11075
84-188	US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760		TI85900446	MN -11	10:11187
84-192	US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760		TI85900704	MN -98B	10:10945
84-196	US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760		TI85900444	MN -11	10:11188
GKSS-					
84/ E/ 22	NTIS (US Sales Only), PC A09/MF A01		DE85750276	MN -78	10:11098
GL-					
3712	*See* AD-A-143538/7				10:11496
GRS-F-					
132	NTIS (US Sales Only), PC A19/MF A01		DE85750305	MN -78	10:11161
136	NTIS (US Sales Only), PC A04/MF A01		DE85750277	MN -78	10:11162
GSF-P-					
277	NTIS (US Sales Only), PC A05/MF A01		DE85750291	MN -28	10:11531
GSF-S-					
957	NTIS (US Sales Only), PC A06/MF A01		DE85750268	MN -34C	10:11898
GSI-					
84-6	NTIS (US Sales Only), PC A06/MF A01		DE85750292	MN -34C	10:11876
84-42(Prepr.)	NTIS (US Sales Only), PC A02/MF A01		DE85750301	MN -28	10:11547
84-43(Prepr.)	NTIS (US Sales Only), PC A03/MF A01		DE85750271	MN -34C	10:11767
84-44(Prepr.)	NTIS (US Sales Only), PC A03/MF A01		DE85750270	MN -34C	10:11890
84-45(Prepr.)	NTIS (US Sales Only), PC A03/MF A01		DE85750272	MN -34C	10:11891
84-46(Prepr.)	NTIS (US Sales Only), PC A04/MF A01		DE85750273	MN -34C	10:11892
84-47(Prepr.)	NTIS (US Sales Only), PC A03/MF A01		DE85750269	MN -34C	10:11884
HEDL-					
7455	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85005717	MN -25	10:10973
7492	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85005719	MN -25	10:11336
7509	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85005720	MN -25	10:11337
7517	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85005718	MN -25	10:11338
HEDL-TME-					
84-20-Vol.1	*See* NUREG/CR-3746-Vol.1		TI85003254	MN -78	10:11088
HSE-Trans-					
8644	NTIS (US Sales Only), PC A02; 3		DE85900538	MN -88	10:10919
10002	NTIS (US Sales Only), PC A02; 3		DE85900531	MN -88	10:10905
IC-					
84/ HENP/ 2	*See* DESY-84-060		DE85750287	MN -34D	10:11557
IFSR-					
162	*See* DOE/ET/53088-162	E 1.99:	DE85005554	MN -20	10:11932
INIS-mf-					
8857	NTIS (US Sales Only), PC A04/MF A01		DE85780107	MN -48	10:11648
8866	NTIS (US Sales Only), PC A02/MF A01		DE85780106	MN -23	10:11647
8867	NTIS (US Sales Only), PC A05/MF A01		DE85780108	MN -48	10:11649
8868	NTIS (US Sales Only), PC A07/MF A01		DE85780116	MN -48	10:11650
8869	NTIS (US Sales Only), PC A05/MF A01		DE85780109	MN -48	10:11651
8870	NTIS (US Sales Only), PC A03/MF A01		DE85780110	MN -48	10:11652
8871	NTIS (US Sales Only), PC A06/MF A01		DE85780111	MN -48	10:11653
8872	NTIS (US Sales Only), PC A09/MF A01		DE85780117	MN -78	10:11163
8873	NTIS (US Sales Only), PC A04/MF A01		DE85780104	MN -48	10:11654
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Report Number	*Availability Source*	*File Number*	*Distribution Category*	*Abstract Number*
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K/P-				
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K/PS-				
864	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85006488	MN -4	10:11429
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3716	NTIS (US Sales Only), PC A03/MF A01	DE85750289	MN -80	10:11164
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3777	NTIS (US Sales Only), PC A24/MF A01	DE85750267	MN -78	10:11099
3781	NTIS (US Sales Only), PC A05/MF A01	DE85750295	MN -34D	10:11824
KTM/E-B-				
28	Kauppa- ja Teollisuusministerio, Helsinki, Finland			10:10888
KTM/E-D-				
41	Kauppa- ja Teollisuusministerio, Helsinki, Finland			10:10877
42	Kauppa- ja Teollisuusministerio, Helsinki, Finland			10:10854
52	Kauppa- ja Teollisuusministerio, Helsinki, Finland			10:11067
L-				
15803	*See* N-84-29479			10:11904
LA-				
9879-MS	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85005599	STD -15	10:11430
10049-M-Rev.1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE85005335	STD -34A	10:11899
10135-C	NTIS, PC A99/MF A01; 1 (GPO Dep.)	E 1.99: DE85004636	STD -15	10:11006
10188-MS	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99: DE85005598	STD -70	10:11000
10199-T	NTIS, PC A06/MF A01 (GPO Dep.)	E 1.99: DE85005317	STD -25	10:11341
10231-SOP	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99: DE85005316	STD -38	10:11485
10255-T	NTIS, PC A07/MF A01 (GPO Dep.)	E 1.99: DE85005318	STD -32	10:12013
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17920	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99: DE85004589	MN -95d	10:11316
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18248	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85005164	MN -59B	10:11291
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18557	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99: DE85004901	MN -38	10:11517
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MLM-				
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MPI-PAE/Exp.El.-				
132	NTIS (US Sales Only), PC A02/MF A01	DE85750302	MN -37	10:11564
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84-29438	NTIS, PC A02/MF A01			10:11661
84-29479	NTIS, PC A02/MF A01			10:11904
84-29694	NTIS, PC A02/MF A01			10:11810
84-29841	NTIS, PC A02/MF A01			10:11741
84-30566	NTIS, PC A03/MF A01			10:11589
84-30937	NTIS, PC A02/MF A01			10:11843
84-30938	NTIS, PC A02/MF A01			10:11844
84-30939	NTIS, PC A02/MF A01			10:11825
84-30940	NTIS, PC A02/MF A01			10:11854
84-30949	NTIS, PC A07/MF A01			10:11826
84-30962	NTIS, PC A03/MF A01			10:11749
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Report Number	*Availability Source*	*File Number*	*Distribution Category*	*Abstract Number*
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84-33336	NTIS, PC A12/MF A01			10:11732
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12511	NTIS, PC A02; 3	DE85004477	MN -80	10:11114
12550	NTIS, PC A02; 3	DE85004473	MN -80	10:11344
NASA-CR-				
171799	*See* N-84-29841			10:11741
173825	*See* N-84-31068			10:11742
NASA-TM-				
86099	*See* N-84-31079			10:11743
86124	*See* N-84-30962			10:11749
86285	*See* N-84-30566			10:11589
86904	*See* DOE/NASA/51040-59	E 1.99: DE85004683	STD -25	10:11317
NASA-TP-				
2344	*See* N-84-29479			10:11904
NBS/TN-				
1074	*See* PB-84-217884			10:11487
NCI/ICRDB/OT-				
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NEL-Trans-				
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NERDDP-CS-				
82-5	National Energy Research, Development and Demonstration Council, Canberra, Australia			10:11215
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82-86	National Energy Research, Development and Demonstration Council, Canberra, Australia			10:10845
83-70	National Energy Research, Development and Demonstration Council, Canberra, Australia			10:10926
83-76	National Energy Research, Development and Demonstration Council, Canberra, Australia			10:10932
83-103	National Energy Research, Development and Demonstration Council, Canberra, Australia			10:10889
83-104	National Energy Research, Development and Demonstration Council, Canberra, Australia			10:10855
83-105	National Energy Research, Development and Demonstration Council, Canberra, Australia			10:10846
83-109	National Energy Research, Development and Demonstration Council, Canberra, Australia			10:10895
83-112	National Energy Research, Development and Demonstration Council, Canberra, Australia			10:10890
83-113	National Energy Research, Development and Demonstration Council, Canberra, Australia			10:10896
83-119	National Energy Research, Development and Demonstration Council, Canberra, Australia			10:10891
83-120	National Energy Research, Development and Demonstration Council, Canberra, Australia			10:10892
83-122	National Energy Research, Development and Demonstration Council, Canberra, Australia			10:10915
83-126	National Energy Research, Development and Demonstration Council, Canberra, Australia			10:10916
83-127	National Energy Research, Development and Demonstration Council, Canberra, Australia			10:10897
83-130	National Energy Research, Development and Demonstration Council, Canberra, Australia			10:10847
83-133	National Energy Research, Development and Demonstration Council, Canberra, Australia			10:10856
83-135	National Energy Research, Development and Demonstration Council, Canberra, Australia			10:10927
83-136	National Energy Research, Development and Demonstration Council, Canberra, Australia			10:10898
83-144	National Energy Research, Development and Demonstration Council, Canberra, Australia			10:10857
83-148	National Energy Research, Development and Demonstration Council, Canberra, Australia			10:10899
83-149	National Energy Research, Development and Demonstration Council, Canberra, Australia			10:10917
83-150	National Energy Research, Development and Demonstration Council, Canberra, Australia			10:10900
83-153	National Energy Research, Development and Demonstration Council, Canberra, Australia			10:10858
83-154	National Energy Research, Development and Demonstration Council, Canberra, Australia			10:10901
83-160	National Energy Research, Development and Demonstration Council, Canberra, Australia			10:10928
83-163	National Energy Research, Development and Demonstration Council, Canberra, Australia			10:10859
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Report Number	Availability Source	File Number		Distribution Category	Abstract Number
83-168	National Energy Research, Development and Demonstration Council, Canberra, Australia				10:10860
83-175	National Energy Research, Development and Demonstration Council, Canberra, Australia				10:10918
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23-Vol.1	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004850	MN -92	10:10938
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5900363	Salmon Brothers Inc., One New York Plaza, New York, NY 10004		TI85900363	ND -92	10:11216
5900441	Laboratory of Architecture and Planning, MIT, Cambridge, MA 02139		TI85900441	MN -95e	10:11314
5900686	Eastman Kodak Co., 901 Elmgrove Rd., Rochester, NY 14650		TI85900686	MN -38	10:11518
NPS-					
52-84-014	*See* AD-A-146786/9/XAB				10:12007
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NRL-MR-					
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NUREG-					
0420-Suppl.8	NTIS, PC A05/MF A01 - GPO* $4.75		TI85900849	MN -78	10:11166
0748-Vol.4-No.10	NTIS, PC A14/MF A01 - GPO*		TI85900851	MN -80	10:11116
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3442	NTIS, PC A18/MF A01 - GPO		TI84016513	MN -11	10:11636
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1859	NTIS (US Sales Only), PC A02/MF A01; 1		DE85900530	MN -95f	10:11312
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84-0023-Vol.1	Alaska OCS Region, MMS, P.O. Box 101159, Anchorage, AK 99510		TI85900549	MN -92a	10:10943
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ORNL/Sub-					
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7179/ R1	NTIS, PC A11/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004772	STD -71	10:11486
8869	*See* NUREG/CR-3442		TI84016513	MN -11	10:11636
9110	NTIS, PC A11/MF A01; 1 (GPO Dep.)	E 1.99:	DE85000664	STD -20	10:11978
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9289	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE85004109	STD -41	10:11581
9314	NTIS, PC A12/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004956	MN -70	10:10978
9326	NTIS, PC A07/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004777	MN -70	10:11625
9403	NTIS, PC A05/MF A01 (GPO Dep.)	E 1.99:	DE85005336	STD -48	10:11687
9417	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85004946	MN -80	10:11136
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Report Number	*Availability Source*	*File Number*		*Distribution Category*	*Abstract Number*
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84-922801/ XAB	NTIS PC $8.00/MF $8.00				10:11659
85-105401/ XAB	NTIS PC E04/MF E01				10:11022
85-108280/ XAB	NTIS PC E04/MF E01				10:11023
85-109296/ XAB	NTIS, PC A04/MF A01				10:10879
85-109494/ XAB	NTIS, PC A02/MF A01				10:10870
85-110237/ XAB	NTIS PC E05/MF E01				10:11942
85-110849/ XAB	NTIS, PC A03/MF A01				10:11294
85-112209/ XAB	NTIS, PC A06/MF A01				10:11189
85-112811/ XAB	NTIS, PC A09/MF A01				10:11213
85-117034/ XAB	NTIS, PC A13/MF A01				10:11190
85-117638/ XAB	NTIS PC E03/MF E03				10:11591
85-118024/ XAB	NTIS, PC A05/MF A01				10:11675
85-118529/ XAB	NTIS, PC A05/MF A01				10:11310
85-900501	*See* DOE/HIR-85/1	E 1.99:	DE85003160	STD -34C	10:11863
PFC/CP-					
84-12	*See* DOE/ET/51013-122	E 1.99:	DE85004914	MN -21	10:11976
84-15	*See* DOE/ET/51013-134	E 1.99:	DE85004845	MN -20f	10:11930
PNL-					
4046-Ed.2	NTIS, PC A10/MF A01; 1 (GPO Dep.)	E 1.99:	DE85005542	MN -11	10:11592
4621-Final	NTIS, PC A99/MF A01; 1 (GPO Dep.)	E 1.99:	DE85005817	MN -11	10:11611
5152-Pt.4	NTIS, PC A11/MF A01; 1 (GPO Dep.)	E 1.99:	DE85005430	MN -11	10:11593
5247	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85005629	MN -11	10:11665
5298	NTIS, PC A16/MF A01 (GPO Dep.)	E 1.99:	DE85005324	MN -11	10:11594
5302	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85005428	MN -11	10:11618
5325	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85005170	MN -11	10:11637
5331	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85005429	MN -41	10:11168
PNL-SA-					
10350(2)	NTIS, PC A02; 3		DE85005527	MN -4	10:11463
10729	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85005521	MN -94e	10:11176
11064	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85005528	MN -11	10:11621
11243	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85005526	MN -41	10:11612
11302	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85006087	MN -13	10:11626
11484	NTIS, PC A02; 3		DE85005524	MN -34A	10:11900
11546	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85005523	MN -61B	10:11027
11547	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85005522	MN -61B	10:11028
11622	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85004558	MN -90d	10:10861
11623	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85004545	MN -90d	10:10862
11885	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85005525	MN -61D	10:11018
12071	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85005518	MN -34C	10:11901
12151	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85004537	MN -11	10:11632
12174	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85000366	MN -70	10:10979
12304	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004535	MN -25	10:10980
12310	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004552	MN -25	10:11410
12314	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85004555	MN -25	10:10981
12320	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004557	MN -25	10:10982
12326	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004553	MN -25	10:11345
12341	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85004547	MN -25	10:11346
12355	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85005293	MN -70	10:10983
12360	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85005291	MN -70	10:10984
12393	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85004556	MN -70	10:10985
12703	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	TI85004546	MN -41	10:11905

Report Number	Availability Source	File Number		Distribution Category	Abstract Number
12709	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85003601	MN -11	10:11633
12758	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85005286	MN -34B	10:11566
PNL-tr-					
444	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE85005490	MN -70	10:10994
PPPL-					
2170	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85005344	STD -20f	10:11943
2171	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85005341	STD -20f	10:11944
2177	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85005352	STD -20f	10:11945
2178	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85005340	STD -20f	10:11946
PSI-TR-					
455	*See* DOE/MC/15078-7-3	E 1.99:	DE85005423	MN -93	10:11276
R-					
1288	*See* PB-85-118529/XAB				10:11310
RFP-					
3548	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004098	MN -38	10:11513
3652	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85005176	MN -10	10:10957
3655	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004696	MN -4	10:11347
3685	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85004970	MN -10	10:11464
3704	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004973	MN -10	10:10986
3715	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85005321	STD -25	10:11348
RFP-Trans-					
441	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85005305	MN -10	10:10956
RHO-PB-SR-					
10-B-WM-Nov.84	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004937	MN -70	10:10987
10-B-WM-Oct.84	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004707	MN -70	10:10988
RISLEY-Trans-					
3168	NTIS (US Sales Only), PC A02; 3		DE85900115	MN -25	10:11386
RISO-M-					
2420	Risoe National Lab., Roskilde, Denmark				10:10880
RSRE-MEMO-					
3670	*See* AD-A-143216/0				10:11493
SAND-					
83-2505	NTIS, PC A03; 3		DE85004931	MN -71	10:10966
84-0185	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE85006455	STD -23	10:11008
84-0221	NTIS, PC A06/MF A01; 1 (GPO Dep.)	E 1.99:	DE85006135	MN -70	10:10989
84-0797	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85006457	STD -23	10:11009
84-0862C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85005590	MN -25	10:11411
84-0959C	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85003950	MN -4	10:11915
84-1230C	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85003677	MN -25	10:11349
84-1292C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85005483	MN -25	10:11350
84-1324C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85005481	MN -25	10:11412
84-1431	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85005322	MN -90d	10:10849
84-1444	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99:	DE85005499	MN -70	10:10990
84-1811C	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	TI85003532	MN -80	10:11169
84-1843C	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85004012	MN -78	10:11170
84-1845C	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85002640	MN -78	10:11171
84-1896	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85005299	MN -32	10:11902
84-2022	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004355	STD -34	10:11519
84-2216C	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85003340	MN -78	10:11172
84-2282C	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85002622	MN -78	10:11173
84-2304C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004460	MN -38	10:11478
84-2526C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85003946	MN -32	10:11928
84-7211C	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85005489	MN -70	10:10991
84-8183	NTIS, PC A06/MF A01 (GPO Dep.)	E 1.99:	DE85005303	MN -62c	10:11049
84-8251	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99:	DE85005302	MN -62a	10:11059
84-8937	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85006321	MN -25	10:11351
SERI/CP-					
211-2507	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99:	DE84013047	MN -63	10:11035
SERI/SP-					
271-2470	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE84013031	MN -62	10:11060
SERI/STR-					
211-2475	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99:	DE85002905	MN -63	10:11036
211-2557	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85002909	MN -63	10:11037
211-2558	NTIS, PC A04/MF A01; 1 (GPO Dep.)	E 1.99:	DE85002908	MN -63	10:11038
SGD-					
477-PT-2	*See* PB-84-225036				10:11744
SLAC-PUB-					
3455	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004676	MN -28	10:11552
3465	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004679	MN -28	10:11567
3466	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004678	MN -28	10:11553
3471	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004681	MN -28	10:11554
3475	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85005533	MN -28	10:11568
3491	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004680	MN -28	10:11569
3502	NTIS, PC A02; 3		DE85005535	MN -34D	10:11570
3509	NTIS, PC A02; 3		DE85005537	MN -28	10:11534
3511	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004677	MN -38	10:11520
SOL-					
84-10	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004784	MN -32	10:12016
TB-					
83-7	*See* N-84-29694				10:11810
TR-					
3	*See* AD-A-143469/5				10:11324
8226/ 1	*See* PB-84-221829				10:11309

Report Number	*Availability Source*	*File Number*		*Distribution Category*	*Abstract Number*
TRI-PP-					
84-100	NTIS (US Sales Only), PC A02/MF A01		DE85900432	MN -34C	10:11867
TRITA-PFU-					
83-07	Royal Inst. of Tech., Plasma Physics and Fusion Research, Stockholm, Sweden			ND -37	10:11947
TTC-					
0461	*See* SAND-83-2505		DE85004931	MN -71	10:10966
TVA/OP/CEM-					
84/ 48-Vol.2	NTIS, PC A12/MF A01; 1 (GPO Dep.)	E 1.99:	DE85000041	MN -11	10:11595
84/ 84-Vol.1	NTIS, PC A09/MF A01 (GPO Dep.)	E 1.99:	DE85004489	MN -11	10:11596
TVA/PUB-					
85/ 5	NTIS, PC A02/MF A01; 1		DE85900880	MN -97d	10:11218
UCB/RP-					
84/ D1020	*See* DOE/OR/21400-T85	E 1.99:	DE85005327	MN -90h	10:11335
UCID-					
18574-84-2	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE85004990	MN -25	10:11323
20141	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE85005304	MN -20d	10:11983
20214	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85005301	MN -38	10:11521
20283	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85005300	MN -38	10:11488
20297-84-4	NTIS, PC A02MF A01; 1 (GPO Dep.)	E 1.99:	DE85005479	MN -34A	10:11477
20301	NTIS PC E02/MF A01 (GPO Dep.)	E 1.99:	DE85006267	MN -85	10:10992
20310	NTIS, PC A05/MF A01; 1 (GPO Dep.)	E 1.99:	DE85006140	MN -45	10:11582
30189-Rev.1	NTIS, PC A03; 3		DE85006155	MN -32	10:12017
30200-83-2	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85005553	MN -32	10:11479
UCRL-					
15644	NTIS, PC A08/MF A01 (GPO Dep.)	E 1.99:	DE85006145	MN -48	10:11676
15645	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE85006165	MN -32	10:12018
15646	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85006157	MN -32	10:11929
15648	NTIS, PC A04/MF A01 (GPO Dep.)	E 1.99:	DE85006255	MN -4	10:11393
52000-84-12	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85005541	STD -2	10:12005
90682	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85006156	MN -4	10:11413
91408	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85004993	MN -32	10:11918
91446	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85006450	MN -11	10:11597
91830	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85004988	MN -11	10:11598
91854	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85004989	MN -11	10:11599
UCRL-Trans-					
12010	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85001181	MN -4	10:11436
12011	NTIS, PC A02/MF A01; 1 (GPO Dep.)	E 1.99:	DE85000344	MN -34	10:11504
UILU-ENG-					
84-2548	*See* AD-A-143295/4				10:11494
UNI-SA-					
138	NTIS, PC A02/MF A01 (GPO Dep.)	E 1.99:	DE85004550	MN -85	10:10965
USGS-OFR-					
78-336	USGS-OFR, Box 25425, Denver Federal Center, Denver, CO 80225; 3		TI83902524	MN -11	10:11715
USIP-					
84-08	*See* N-84-30940				10:11854
WINCO-					
1028	NTIS, PC A03/MF A01; 1 (GPO Dep.)	E 1.99:	DE85004789	MN -83	10:10993
WUD-					
83-1	NTIS (US Sales Only), PC A05/MF A01		DE85750266	MN -28	10:11555
Y/DV-					
397	NTIS, PC A03/MF A01 (GPO Dep.)	E 1.99:	DE85006179	MN -25	10:11352

FILE NUMBER CORRELATION

This correlation list is provided for those organizations where document storage is alphanumeric by report number and request may be received by file number. For other information about a document (abstract number, distribution category, availability, and price), please refer to the Report Number Index.

File No.	*Report No.*
DE83015291	DOE/TIC—3401
DE84008569	CONF-8403108—2
DE84013031	SERI/SP—271-2470
DE84013047	SERI/CP—211-2507
DE84015345	CONF-831104—Summs.
DE84015357	DOE/CE/15101—T1
DE84016839	DOE/ET/15440—19
DE84017499	DOE/DP—0021
DE84703446	CTA-IEAV-NT—010/83
DE85000035	DOE/FE/60339—T7
DE85000041	TVA/OP/CEM—84/48-Vol.2
DE85000107	DOE/BC—84/3
DE85000270	CONF-8410142—10
DE85000318	ORNL—6026-Vol.7
DE85000344	UCRL-Trans—12011
DE85000366	PNL-SA—12174
DE85000664	ORNL/TM—9110
DE85000736	DOE/ET/20645—1
DE85000980	ORNL—6026-Vol.10
DE85000982	ORNL—6026-Vol.9
DE85001181	UCRL-Trans—12010
DE85001267	ORNL—6026-Vol.14
DE85001268	ORNL—6026-Vol.13
DE85001269	ORNL—6026-Vol.12
DE85001284	ORNL—6026-Vol.8
DE85001382	ORNL—6026-Vol.6
DE85001499	ORNL/TM—9231
DE85001562	DOE/OR/03054—T37-Vol.1
DE85001616	DOE/OR/03054—T24
DE85001632	DOE/OR/03054—108
DE85001695	ORNL/TM—9229
DE85001696	ORNL—6026-Vol.16
DE85001697	ORNL—6026-Vol.17
DE85001876	ORNL—6026-Vol.15
DE85001878	ORNL—6026-Vol.11
DE85001987	DOE/MC/20370—1700
DE85001988	DOE/MC/20035—1702
DE85002105	ORNL—6026-Vol.5
DE85002107	ORNL—6026-Vol.3
DE85002108	ORNL—6026-Vol.4
DE85002109	ORNL—6026-Vol.1
DE85002110	ORNL—6026-Vol.2
DE85002577	CONF-8410170—3
DE85002578	CONF-8410170—4
DE85002622	SAND—84-2282C
DE85002640	SAND—84-1845C
DE85002768	CONF-8409179—5
DE85002898	DOE/RA/50158—1
DE85002905	SERI/STR—211-2475
DE85002908	SERI/STR—211-2558
DE85002909	SERI/STR—211-2557
DE85003160	DOE/HIR—85/1
DE85003217	DOE/CS/31587—T3-Vol.1
DE85003218	DOE/CS/31587—T3-Vol.2
DE85003280	EPRI-NP—3243-CCM-Vol.2
DE85003340	SAND—84-2216C
DE85003488	DOE/EA—0118
DE85003601	PNL-SA—12709
DE85003656	DP-MS—84-100
DE85003670	DOE/NBM—1078
DE85003677	SAND—84-1230C
DE85003708	DOE/PC/60806—T2
DE85003747	LA-UR—84-3566
DE85003780	FNAL/C—84/99-T
DE85003893	CONF-8308103—2
DE85003922	FNAL/C—84/111-A
DE85003924	FNAL/C—84/117-A
DE85003937	CONF-8404219—1
DE85003946	SAND—84-2526C
DE85003950	SAND—84-0959C
DE85003951	FNAL/C—84/105
DE85004012	SAND—84-1843C
DE85004035	DOE/ER/40025—31
DE85004048	K/D—5313
DE85004059	BNL—35311
DE85004063	ANL-HEP-CP—84-86
DE85004065	ANL/HEP-CP—84-87
DE85004069	CONF-841184—24
DE85004071	DOE/NBM—5004071
DE85004073	CONF-8410165—3
DE85004076	DOE/NV/10162—19
DE85004083	CONF-850712—3
DE85004084	CONF-841136—3
DE85004098	RFP—3548
DE85004103	DOE/PC/40275—2
DE85004109	ORNL/TM—9289
DE85004128	LBL—18397
DE85004160	BNL—35279
DE85004173	K/P—6816
DE85004189	BNL—35486
DE85004233	DOE/PC/60812—T4
DE85004234	DOE/PC/60812—T5
DE85004236	DOE/PC/63048—T1
DE85004237	DOE/PC/60812—T3
DE85004269	FNAL/C—84/88-T
DE85004289	DOE/EV/02217—51
DE85004302	DOE/TRU—8201
DE85004310	DOE/ET/10137—T11
DE85004317	EGG-M—24584
DE85004323	DOE/EIA—0438(84)
DE85004355	SAND—84-2022
DE85004377	DOE/PC/63032—T5
DE85004378	DOE/RA/50292—T2
DE85004413	CONF-841210—3
DE85004437	CONF-830803—11
DE85004460	SAND—84-2304C
DE85004473	NAA-SR-TDR—12550
DE85004477	NAA-SR-TDR—12511
DE85004489	TVA/OP/CEM—84/84-Vol.1
DE85004496	DOE/R0/01261—T1
DE85004504	DOE/R0/01326—T1
DE85004506	DOE/R0/00040—T1
DE85004507	DOE/EV/10665—5
DE85004508	CONF-8405216—1
DE85004516	DOE/CS/40442—T1
DE85004535	PNL-SA—12304
DE85004537	PNL-SA—12151
DE85004545	PNL-SA—11623
DE85004547	PNL-SA—12341
DE85004550	UNI-SA—138
DE85004552	PNL-SA—12310
DE85004553	PNL-SA—12326
DE85004555	PNL-SA—12314
DE85004556	PNL-SA—12393
DE85004557	PNL-SA—12320
DE85004558	PNL-SA—11622
DE85004586	DOE/AL/16222—T1
DE85004589	LBL—17920
DE85004590	LBL—18626
DE85004592	LBL—18731
DE85004593	LBL—17514
DE85004599	DOE/ET/53043—T2
DE85004603	LBL—18681
DE85004606	LBL—18708
DE85004607	LBL—18701
DE85004608	LBL—18712
DE85004611	LBL—18697
DE85004612	LBL-PUB—3034-Rev.
DE85004636	LA—10135-C
DE85004655	LBL—16220
DE85004676	SLAC-PUB—3455
DE85004677	SLAC-PUB—3511
DE85004678	SLAC-PUB—3466
DE85004679	SLAC-PUB—3465
DE85004680	SLAC-PUB—3491
DE85004681	SLAC-PUB—3471
DE85004683	DOE/NASA/51040—59
DE85004693	EGG-M—25484
DE85004696	RFP—3655
DE85004700	BNL—35550
DE85004702	BNL—35568
DE85004704	BNL—35510
DE85004707	RHO-PB-SR—10-B-WM-Oct.84
DE85004712	BNL-NCS—35522
DE85004716	DOE/FE/60338—16
DE85004717	DOE/EIA—0130(84/10)
DE85004721	DOE/EV/10237—T1
DE85004752	CONF-810113—3
DE85004770	ORNL/CON—168
DE85004772	ORNL/TM—7179/R1
DE85004773	ORNL/CON—166
DE85004777	ORNL/TM—9326
DE85004780	CONF-841255—1
DE85004783	DOE/ER/13019—2
DE85004784	SOL—84-10
DE85004789	WINCO—1028
DE85004793	IS-T—1167
DE85004794	DOE/MC/20334—T14
DE85004795	DOE/ER/40033—70
DE85004797	CONF-8410103—4
DE85004801	CONF-841157—44
DE85004802	CONF-8408132—6
DE85004805	LA-UR—76-2656
DE85004814	CONF-841246—11
DE85004817	ANL-HEP-CP—84-77
DE85004818	ANL-HEP-CP—84-76
DE85004826	ANL/CNSV-TM—124
DE85004840	DOE/ER/40025—17
DE85004841	DOE/ER/10699—T4
DE85004842	DOE/ER/40033—55
DE85004845	DOE/ET/51013—134
DE85004847	DOE/RL/01830—T31
DE85004850	NIPER—23-Vol.1
DE85004852	NIPER—23-Vol.3
DE85004856	DOE/EV/00637—13
DE85004857	CONF-841157—47
DE85004859	DOE/ER/40008—68
DE85004863	EGG—10282-1067
DE85004864	EGG—10282-1068
DE85004865	EGG—10282-1069
DE85004866	DOE/ER/40025—19
DE85004867	EGG—10282-1070
DE85004869	DOE/ER/13122—1

File No.	Report No.
DE85004870	CONF-8304153—2
DE85004871	DOE/ER/13216—1
DE85004873	DOE/ER/40025—27
DE85004874	IS-T—1171
DE85004877	DOE/ER/04699—8
DE85004882	DOE/ER/45098—5
DE85004884	DOE/ER/13237—T1
DE85004885	DOE/ER/13041—T2
DE85004886	DOE/ER/40146—1
DE85004888	DOE/EV/10331—4
DE85004893	EGG-M—16284
DE85004895	LBL—14145-Rev.
DE85004898	LBL—18309
DE85004900	LBL—17748
DE85004901	LBL—18557
DE85004914	DOE/ET/51013—122
DE85004922	DOE/ER/10575—T2
DE85004928	DOE/OR/20722—3
DE85004930	DOE/PE—0069
DE85004931	SAND—83-2505
DE85004932	DOE/OR/20722—17
DE85004933	DOE/OR/03054—121
DE85004934	DOE/ER/13224—T1
DE85004937	RHO-PB-SR—10-B-WM-Nov.84
DE85004940	ANL/OEPM—83-5
DE85004941	ORNL/SGMP—84/2
DE85004946	ORNL/TM—9417
DE85004952	ORNL/Sub—83-13858/1
DE85004955	ORNL—6097
DE85004956	ORNL/TM—9314
DE85004958	DOE/CS/94277—T1
DE85004962	CONF-8403130—7
DE85004970	RFP—3685
DE85004973	RFP—3704
DE85004977	DOE/ER—0192
DE85004980	LBL—18010
DE85004981	LBL—18298
DE85004988	UCRL—91830
DE85004989	UCRL—91854
DE85004990	UCID—18574-84-2
DE85004993	UCRL—91408
DE85005015	DOE/ER/40025—T1
DE85005018	CONF-830609—74
DE85005019	CONF-8411118—8
DE85005022	CONF-841136—4
DE85005025	CONF-8410161—3
DE85005026	ANL-HEP-CP—84-74
DE85005027	CONF-841117—33
DE85005028	ANL-HEP-CP—84-82
DE85005030	ANL-HEP-CP—83-45
DE85005036	CONF-830782—5
DE85005039	CONF-831086—14
DE85005047	CONF-8410173—11
DE85005048	CONF-8410173—10
DE85005049	CONF-8411118—10
DE85005050	CONF-831104—3
DE85005058	CONF-8410173—6
DE85005060	CONF-8410173—9
DE85005062	ANL/HEP-CP—84-81
DE85005068	CONF-841194—1
DE85005075	CONF-841121—12
DE85005076	DOE/CS/10118—T1-Vol.1
DE85005077	DOE/CS/10118—T1-Vol.2
DE85005078	DOE/CS/10118—T2
DE85005082	DOE/FE/60406—T1-Vol.4
DE85005108	LBL—18046
DE85005109	LBL—18546
DE85005121	BNL—35374
DE85005124	BNL—35551
DE85005128	BNL—35312
DE85005131	BNL—35495
DE85005133	BNL—35573
DE85005137	BNL—35564
DE85005164	LBL—18248
DE85005170	PNL—5325
DE85005172	EGG-M—22484
DE85005176	RFP—3652
DE85005201	IS-T—1145
DE85005207	BNL—35432
DE85005208	BNL—35728
DE85005209	DOE/PC/50053—T6
DE85005211	DOE/PE/70522—T1
DE85005216	DOE/PC/70775—1
DE85005221	FSEC-CR—108-84
DE85005236	CONF-8411100—3
DE85005241	CONF-841157—60
DE85005257	CONF-8411137—1
DE85005259	CONF-841117—37
DE85005260	CONF-841117—41
DE85005261	CONF-841157—57
DE85005262	CONF-841157—58
DE85005263	CONF-841157—51
DE85005265	CONF-841157—61
DE85005266	CONF-841117—40
DE85005268	IS-T—1184
DE85005275	DOE/MC/14615—T1
DE85005276	CONF-841201—26
DE85005283	CONF-841234—4
DE85005286	PNL-SA—12758
DE85005291	PNL-SA—12360
DE85005293	PNL-SA—12355
DE85005299	SAND—84-1896
DE85005300	UCID—20283
DE85005301	UCID—20214
DE85005302	SAND—84-8251
DE85005303	SAND—84-8183
DE85005304	UCID—20141
DE85005305	RFP-Trans—441
DE85005312	IS-T—1138
DE85005316	LA—10231-SOP
DE85005317	LA—10199-T
DE85005318	LA—10255-T
DE85005321	RFP—3715
DE85005322	SAND—84-1431
DE85005324	PNL—5298
DE85005326	DOE/MC/20122—T1
DE85005327	DOE/OR/21400—T85
DE85005329	DOE/MC/19363—1713
DE85005335	LA—10049-M-Rev.1
DE85005336	ORNL/TM—9403
DE85005340	PPPL—2178
DE85005341	PPPL—2171
DE85005344	PPPL—2170
DE85005346	CONF-841246—8
DE85005352	PPPL—2177
DE85005354	DOE/OR/21400—T81
DE85005355	DOE/OR/21400—T82
DE85005356	CONF-841007—48
DE85005360	CONF-841105—59
DE85005361	CONF-8409169—3
DE85005363	CONF-841246—10
DE85005367	CONF-841157—43
DE85005370	CONF-841005—5
DE85005371	CONF-841003—1
DE85005372	CONF-8410172—5
DE85005374	CONF-841117—35
DE85005377	CONF-841105—54
DE85005378	CONF-841105—58
DE85005382	CONF-841105—52
DE85005383	CONF-841142—2
DE85005386	DOE/PE/06322—T1
DE85005387	DOE/CS/30076—T1
DE85005404	DOE/ER/10453—04
DE85005406	DOE/ER/12054—T1
DE85005409	DOE/ER/40025—T2
DE85005412	DOE/MC/20228—T1
DE85005414	DOE/CS/35308—T1
DE85005417	DOE/EV/10415—2
DE85005418	DOE/LC/10652—T1
DE85005419	DOE/SF/11647—T1
DE85005421	DOE/ER/60095—T3
DE85005423	DOE/MC/15078—7-3
DE85005424	DOE/OR—853
DE85005428	PNL—5302
DE85005429	PNL—5331
DE85005430	PNL—5152-Pt.4
DE85005435	DOE/R4/10460—T1
DE85005436	DOE/EIA—0380(84/10)
DE85005437	DOE/SF/00515—T42
DE85005438	DOE/PC/52274—T5
DE85005445	DOE/R4/10452—T1
DE85005446	DOE/R4/10300—T1
DE85005448	DOE/R4/10228—T1
DE85005449	DOE/R4/10164—T1
DE85005451	DOE/RA/32012—T27
DE85005452	DOE/EV/10564—T1
DE85005470	DOE/SF/11646—T1
DE85005475	DOE/ER/10431—1
DE85005477	DOE/NV/10045—1
DE85005478	DOE/ER/04075—T3
DE85005479	UCID—20297-84-4
DE85005481	SAND—84-1324C
DE85005482	LBL—18726
DE85005483	SAND—84-1292C
DE85005488	IS-T—1169
DE85005489	SAND—84-7211C
DE85005490	PNL-tr—444
DE85005499	SAND—84-1444
DE85005500	FNAL/C—84/93-T
DE85005503	IS-T—1132
DE85005504	IS-T—1163
DE85005510	FNAL/C—84/87-T
DE85005518	PNL-SA—12071
DE85005521	PNL-SA—10729
DE85005522	PNL-SA—11547
DE85005523	PNL-SA—11546
DE85005524	PNL-SA—11484
DE85005525	PNL-SA—11885
DE85005526	PNL-SA—11243
DE85005527	PNL-SA—10350(2)
DE85005528	PNL-SA—11064
DE85005533	SLAC-PUB—3475
DE85005535	SLAC-PUB—3502
DE85005537	SLAC-PUB—3509
DE85005541	UCRL—52000-84-12
DE85005542	PNL—4046-Ed.2
DE85005552	ORNL-tr—5175
DE85005553	UCID—30200-83-2
DE85005554	DOE/ET/53088—162
DE85005567	CONF-840767—16
DE85005585	DOE/ER/13175—1
DE85005590	SAND—84-0862C
DE85005598	LA—10188-MS
DE85005599	LA—9879-MS
DE85005608	DOE/PC/60261—T4
DE85005609	DOE/ER/40145—1
DE85005611	IS-T—1131
DE85005612	IS-T—1120
DE85005617	DOE/MC/16426—14
DE85005624	IS-T—1091
DE85005625	IS-T—1064
DE85005629	PNL—5247
DE85005634	BNL—51830
DE85005635	DOE/NV/10250—17
DE85005637	BNL—51818
DE85005638	DP—1694
DE85005639	BMI/ONWI—524
DE85005641	DOE/ER—0210
DE85005642	DOE/ER—0212
DE85005646	DOE/FE/60148—T9
DE85005647	DOE/FE/60148—T10
DE85005648	DOE/FE/60148—T11
DE85005649	DOE/EI/06540—T1
DE85005651	BNL—51827
DE85005655	DOE/PC/60261—T5
DE85005717	HEDL—7455
DE85005718	HEDL—7517
DE85005719	HEDL—7492
DE85005720	HEDL—7509
DE85005723	LA-UR—84-3805
DE85005726	LA-UR—84-3810
DE85005727	LA-UR—84-3812
DE85005731	DOE/FE—0046
DE85005732	MLM—3213
DE85005817	PNL—4621-Final
DE85006087	PNL-SA—11302
DE85006097	DOE/OR/20992—T1
DE85006108	EGG-IS—6494(1-85)
DE85006135	SAND—84-0221
DE85006140	UCID—20310
DE85006145	UCRL—15644
DE85006155	UCID—30189-Rev.1
DE85006156	UCRL—90682
DE85006157	UCRL—15646
DE85006165	UCRL—15645
DE85006172	DOE/ER/40154—1
DE85006173	DOE/ER/10505—4
DE85006179	Y/DV—397
DE85006181	DOE/MA—0142/1
DE85006226	CONF-841245—1
DE85006255	UCRL—15648
DE85006261	BMI/OCRD—7
DE85006267	UCID—20301
DE85006293	DOE/ET/17076—T1

File No.	Report No.
DE85006297	DOE/EV/10415—T1
DE85006301	DOE/ER/10366—5
DE85006318	BMI/ONWI—529
DE85006321	SAND—84-8937
DE85006325	DOE/EIA—M002
DE85006349	FCR—6827P
DE85006450	UCRL—91446
DE85006455	SAND—84-0185
DE85006457	SAND—84-0797
DE85006459	DOE/ET/32041—T1
DE85006462	DOE/LC/10747—T10
DE85006476	DOE/IR/10297—T2
DE85006480	ONWI—119-Vol.4
DE85006481	ONWI—120-Vol.7
DE85006482	DOE/ER/10407—5
DE85006483	DOE/ET/13077—101
DE85006484	DOE/EIA—0121(84/3Q)
DE85006486	DOE/ER/06042—5
DE85006488	K/PS—864
DE85006492	ANL/CNSV—46
DE85750265	Juel—1903
DE85750266	WUD—83-1
DE85750267	KFK—3777
DE85750268	GSF-S—957
DE85750269	GSI—84-47(Prepr.)
DE85750270	GSI—84-44(Prepr.)
DE85750271	GSI—84-43(Prepr.)
DE85750272	GSI—84-45(Prepr.)
DE85750273	GSI—84-46(Prepr.)
DE85750274	BONN-HE—84-9
DE85750275	BONN-HE—84-11
DE85750276	GKSS—84/E/22
DE85750277	GRS-F—136
DE85750278	DESY—84-052
DE85750280	DESY—84-051
DE85750281	DESY—84-053
DE85750282	DESY—84-050
DE85750283	DESY—84-049
DE85750284	DESY—84-055
DE85750285	DESY—84-056
DE85750286	DESY—84-061
DE85750287	DESY—84-060
DE85750288	DESY—84-059
DE85750289	KFK—3716
DE85750290	Juel-Spez—254
DE85750291	GSF-P—277
DE85750292	GSI—84-6
DE85750293	BONN-HE—84-17
DE85750294	BONN-HE—84-15
DE85750295	KFK—3781
DE85750296	KFK—3457
DE85750297	KFK—3770
DE85750298	KFK—3746
DE85750299	KFK—3712
DE85750300	KFK—3756
DE85750301	GSI—84-42(Prepr.)
DE85750302	MPI-PAE/Exp.El.—132
DE85750303	IPP-III—98
DE85750304	KFK—3739
DE85750305	GRS-F—132
DE85780103	INIS-mf—8887
DE85780104	INIS-mf—8873
DE85780105	INIS-mf—8888
DE85780106	INIS-mf—8866
DE85780107	INIS-mf—8857
DE85780108	INIS-mf—8867
DE85780109	INIS-mf—8869
DE85780110	INIS-mf—8870
DE85780111	INIS-mf—8871
DE85780112	INIS-mf—8874
DE85780113	INIS-mf—8875
DE85780114	INIS-mf—8890
DE85780115	INIS-mf—8892
DE85780116	INIS-mf—8868
DE85780117	INIS-mf—8872
DE85780118	INIS-mf—8886
DE85780119	INIS-mf—8891
DE85780120	INIS-mf—8880
DE85780121	INIS-mf—9138
DE85900013	DOUNREAY-TRANS—892
DE85900115	RISLEY-Trans—3168
DE85900122	CE-Trans—7857
DE85900181	CE-Trans—7730
DE85900432	TRI-PP—84-100
DE85900529	NEL-Trans—2908
DE85900530	OA-tr—1859
DE85900531	HSE-Trans—10002
DE85900538	HSE-Trans—8644
DE85900547	OA-tr—2430
DE85900880	TVA/PUB—85/5
TI83902524	USGS-OFR—78-336
TI84016513	NUREG/CR—3442
TI84901888	NUREG/CP—0051
TI85001477	NUREG/CR—3851-Vol.2
TI85003254	NUREG/CR—3746-Vol.1
TI85003532	SAND—84-1811C
TI85003571	DOE/ET/29040—1
TI85004510	CONF-811042—7
TI85004517	CONF-801163—1
TI85004518	CONF-801107—38
TI85004519	CONF-810801—54
TI85004520	CONF-810621—4
TI85004531	CONF-810406—8
TI85004539	CONF-810406—10
TI85004546	PNL-SA—12703
TI85004723	CONF-801091—10
TI85004724	CONF-800747—2
TI85004730	CONF-801045—2
TI85004736	BNL-NUREG—28738
TI85004741	CONF-810803—21
TI85004744	CONF-810804—21
TI85004745	CONF-810803—22
TI85004746	CONF-810803—23
TI85004750	CONF-810804—18
TI85004751	CONF-801107—26
TI85004753	CONF-810120—7
TI85004754	CONF-810406—9
TI85004761	CONF-801091—3
TI85004763	CONF-801091—1
TI85004835	BNL-NUREG—28186
TI85004858	DOE/ER/13167—2
TI85005129	BNL-NUREG—35520
TI85005369	CONF-841105—57
TI85900221	AD-A—142076
TI85900347	OTA-BP-F—27
TI85900355	NUREG—0934
TI85900363	NP—5900363
TI85900441	NP—5900441
TI85900444	GAO/RCED—84-196
TI85900445	GAO/RCED—84-186
TI85900446	GAO/RCED—84-188
TI85900449	GAO/RCED—84-149
TI85900516	OCS/MMS—84-0023-Vol.2
TI85900549	OCS/MMS—84-0023-Vol.1
TI85900679	NUREG—0748-Vol.4-No.11
TI85900686	NP—5900686
TI85900704	GAO/RCED—84-192
TI85900742	EPA—600/S4-84-055
TI85900849	NUREG—0420-Suppl.8
TI85900851	NUREG—0748-Vol.4-No.10
TI85900886	CONF-8404201—9
TI85900890	CONF-8404201—3
TI85900896	CONF-8404201—10
TI85920098	EPRI-NP—3574-SR
TI85920099	EPRI-NP—3684-SR-Vol.2
TI85920102	EPRI-NP—1850-CCM-Vol.3-Rev.2
TI85920104	EPRI-NP—3703
TI85920126	EPRI-NP—1850-CCM-Vol.2-Rev.2
TI85920130	EPRI-EL—3775
TI85920145	EPRI-NP—3718

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RA Report analytic
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D Thesis or dissertation
TG Translation (general)
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TO Tonga
TR Turkey
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TW Taiwan
TZ United Republic of Tanzania

UA Ukrainian Soviet Socialist Republic (Ukrainian SSR)
UG Uganda
US United States of America (USA)
UY Uruguay

VA Holy See
VD Democratic Republic of Vietnam
VE Venezuela
VS Republic of Vietnam

WS Western Samoa

YD Democratic Yemen
YE Yemen
YU Yugoslavia

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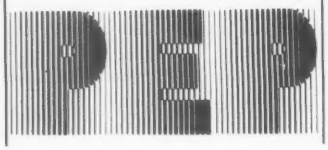

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